DEFENSE INFORMATION SYSTEMS AGENCY
JOINT INTEROPERABILITY AND ENGINEERING
ORGANIZATION (JIEO)
FORT MONMOUTH, NEW JERSEY 07703-5613

ASSESSMENT OF OPTIONS FOR IMPROVING THE 5-KHZ UHF DAMA WAVEFORM

DTIC QUALITY INSPECTED 2

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JIEO REPORT
10 May 1995

1/21/98

Defense Information Center
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Reference our 01/20/98 telephone discussion. The two
requested publications are attached: Assessment of Options
for Improving the 5-kHz UHF DAMA Waveform, 10 May 95; and
Tutorial on Set-up and Communications Delays for All UHF
SATCOM DAMA Modes of Operation, 20 Jun 94. The author (A.
Pappas) places no restrictions on the distribution of these
publications.

If I can be of further help, let me know.

Bob Hager

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BRIEFING ON

ASSESSMENT OF OPTIONS

FOR IMPROVING THE

5-KHZ UHF DAMA WAVEFORM

1. BRIEFING COVER PAGE

This briefing has been prepared by the Joint Interoperability and Engineering Organization, whose principal interest is to improve joint interoperability among command, control, communications, and intelligence (C3I) systems. JIEO prepared the briefing based on Military Communications-Electronics Control Board (MCEB) direction to address user operational issues with the 5-kHz UHF DAMA waveform. The briefing will be used to help UHF SATCOM users understand the efficiency versus operational effectiveness trade-offs in the implementation of contemplated improvements to the 5-kHz UHF DAMA waveform. This understanding will enable users to actively participate in the design of the improved 5-kHz waveform.

UHF SATCOM Standards Assessment of Options for Improving the 5-kHz UHF DAMA Waveform

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DEFENSE INFORMATION SYSTEMS AGENCY

2. OVERVIEW

This briefing is divided into seven parts. The first two parts are introductory in nature and are fairly short sections. The first part states the objectives of the presentation. Next, the background is presented leading up to the tasking to prepare this briefing by the Joint Staff. The last five parts are substantial and address the following areas:

- UHF DAMA SATCOM Principles - Provides a basic tutorial on UHF SATCOM DAMA concepts geared toward non-technically oriented audiences and addressing the 5- and 25-kHz waveforms

- User Operational Issues - Presents user-identified operational problems including set-up and communications delays, waveform synchronization, COMSEC periods, and channel switching between 5- and 25-kHz waveforms.

- Alternative Options Evaluation - Presents the descriptions of the alternative options proposed to address the operational issues.

- Evaluation of Options - Presents an assessment of each option.

- Follow-on Actions - Provides a proposed process for finalizing the selection and implementation of the improvements to the waveforms to solve operational issues.

UHF SATCOM Standards Overview

- Objectives
- Background
- Review of DAMA Principles
- User Operational Issues
- Alternative Options
- Evaluation of Options
- Follow-on Actions

3. OBJECTIVES

The purpose of this briefing is to present the results of the development and assessment of alternative options for improving the 5-kHz UHF DAMA waveform to address several inherent operational issues. This document provides a tutorial of UHF SATCOM principles, a description of the operational issues, and the alternative options and assessment for resolving those issues.

UHF SATCOM Standards
Objectives

- Present assessment of options to improve 5-kHz waveform

  - State user operational issues

  - Develop waveform options

  - Assess waveform options

3. OBJECTIVES

The purpose of this briefing is to present the results of the development and assessment of alternative options for improving the 5-kHz UHF DAMA waveform to address several inherent operational issues. This document provides a tutorial of UHF SATCOM principles, a description of the operational issues, and the alternative options and assessment for resolving those issues.

UHF SATCOM Standards

Background

- JCS has directed implementation of UHF DAMA by September 1996

- Users had operational concerns

- JIEO developed a tutorial to explain DAMA, highlighting concerns with 5-kHz operation

- JS directed JIEO to investigate options for addressing these issues

- A user-developer team approach has been adopted

4. BACKGROUND

The JCS has issued memorandum MJCS-63-89 requiring all of the services to be capable of UHF SATCOM DAMA operation by the end of FY 96. As this transition point approaches, organizations are asking for more information on the new DAMA system and how its implementation is likely to affect them. Several organizations have studied the implementation standards and have become alarmed at projected call set-up times and communications delays that can occur when operating in the various DAMA modes.

These concerns were voiced at the MILSATCOM Users Conference 93-1. As a result, the Joint Staff directed that a tutorial be developed to help users understand exactly what capabilities are available with DAMA, the vast improvement in service, and the operational drawbacks. The tutorial offered a comprehensive explanation of the flexibility and benefits of the 5- and 25-kHz DAMA waveforms and highlighted the operational drawbacks of the 5-kHz waveform. It became immediately evident that the 5-kHz waveform had to be improved to provide better voice services. Therefore, it was decided to prepare an assessment of improvement options for presentation to the user community and employ a user-developer team approach to preclude the design of an operationally deficient system. You must understand that the original DAMA system was developed by systems and design engineers with the all-important objective of efficiency, since they knew that UHF resources were scarce and they needed to serve as many users as possible. The problem with this approach is that it produced a very efficient system, but at the cost of operational effectiveness, which we now realize must be traded-off for efficiency. Therefore, to obtain the proper balance of efficiency and operational effectiveness, the user will be part of the team to provide input to design improvements to the 5-kHz waveform.

This briefing will present a number of viable alternatives to improve the waveform as well as the results of an assessment to highlight the advantages and disadvantages of implementing each. The plan is to open the channels of communication with the users in designing a system that provides both efficiency and operational effectiveness through a user-developer team concept.

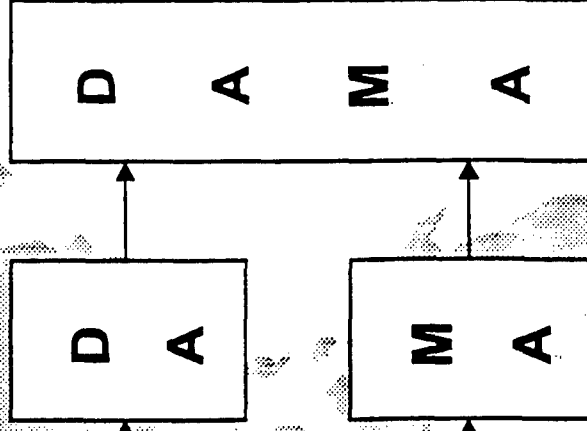# UHF SATCOM Standards
DAMA Principles: "What is DAMA?"

- DAMA

D	A	M	A

DEMAND ASSIGNMENT

(USERS ARE ASSIGNED COMMUNICATIONS ON DEMAND; THEREFORE, SYSTEM IS MORE EFFICIENT)

D	A

MULTIPLE ACCESS

(ABILITY OF A SINGLE CHANNEL TO BE ACCESSED BY MULTIPLE USER NETS)

M	A

ALLOCATION IN REAL TIME

5. WHAT IS DAMA?

This part of the briefing presents UHF SATCOM principles in a tutorial format to which a non-technically oriented user can relate. DAMA is a communications channel access and resource allocation technique that provides the dynamic sharing of one or more channels among many users or user networks. Thousands of satellite terminals, within the same satellite coverage area, may share the channels of one or more satellites. Worldwide multi-user SATCOM connectivity can be provided by using relay schemes between channels on adjacent satellites of the DoD UHF SATCOM constellation.

The concept of DAMA is very simple. Given that there is a pool of resources that can be shared, such as UHF satellite channels, the channels can be assigned for use on demand -- thus, the term Demand Assigned. Since many users are able to share or access the channels, the system is said to have Multiple Access. Therefore, the term DAMA means that multiple users can have access to a pool of resources on demand, which translates in our case to UHF SATCOM assigned to users on demand. Therefore, channel capacity is not being wasted when the particular net assigned to a channel is not communicating.

In addition to improving the efficiency of space resources, DAMA provides efficient use of the terminal segment. DAMA satellite terminals can participate in multiple networks, because they can be designed with the ability to communicate on any of the UHF MILSATCOM channels, both 5- and 25-kHz.

Essentially, DAMA is allocation of resources on a real-time basis.

UHF SATCOM Standards
DAMA Principles:
"What is TDMA?"

- **TDMA**
  - ANALOGOUS TO TIME-DIVISION MULTIPLEXING
  - ALLOWS MULTIPLE USERS TO SHARE A CHANNEL BY GIVING INDIVIDUAL USERS ACCESS TO THE ENTIRE CHANNEL FOR SPECIFIED AND SEQUENTIAL TIME INTERVALS (FRACTIONS OF A SECOND)

Control

Communications

Time Slot

Orderwires	1	2	● ● ●	N

Frame 1

Orderwires	1	2	● ● ●	N

Frame 2
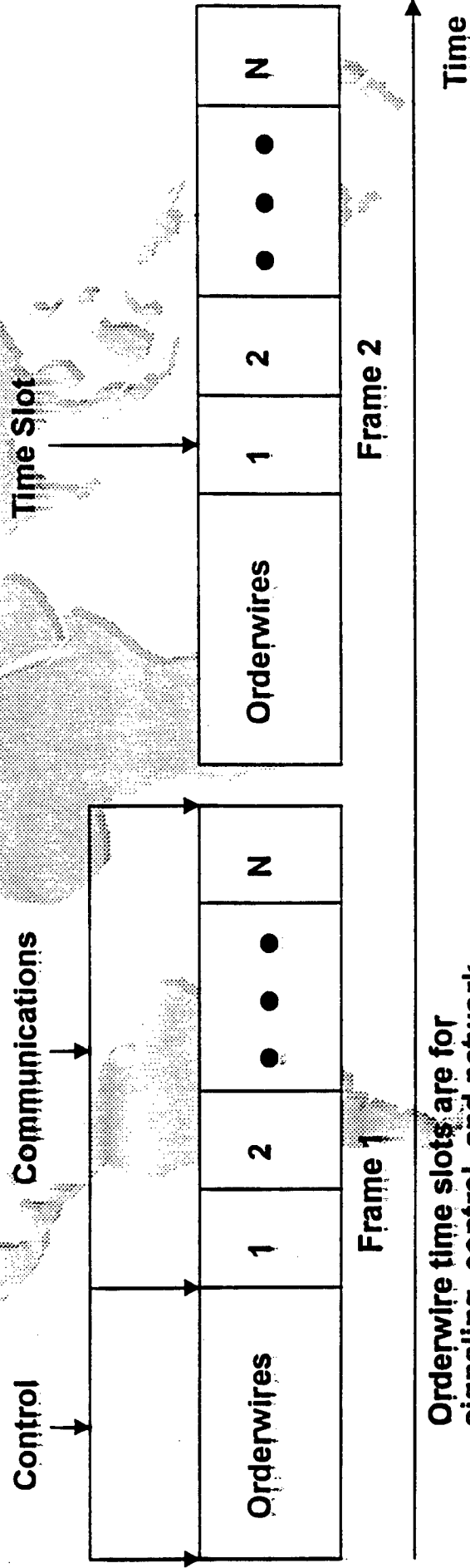
Time

Orderwire time slots are for signaling, control, and network management data.

7. WHAT IS TDMA/DAMA

TDMA/DAMA is simply assigning time slots to user nets on a demand basis. As the slide illustrates, TDMA is used to allow more than one net to share a single channel and provides the multiple access portion. The time slots are assigned on a demand basis, which accounts for the demand assigned portion. This mode provides both the efficiencies of placing more than one user on the same satellite channel, as well as the assignment of resources only when they are needed. The next slide illustrates how TDMA/DAMA works.
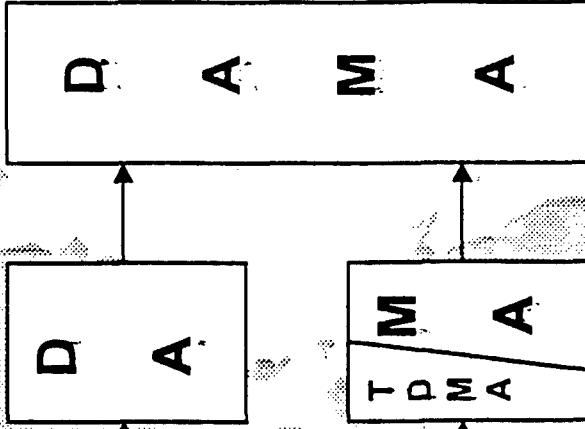
UHF SATCOM Standards
DAMA Principles:
"What is TDMA/DAMA?"

- TDMA/DAMA

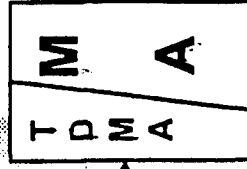| D		
A		
M		
A		

D		T/M
A		A

DEMAND ASSIGNMENT

(USERS ARE ASSIGNED COMMUNICATIONS ON DEMAND; THEREFORE, SYSTEM IS MORE EFFICIENT)

MULTIPLE ACCESS

(ABILITY OF A SINGLE CHANNEL TO SERVICE MULTIPLE USER NETS AT THE SAME TIME, USING TDMA)

8. TDMA/DAMA

This slide illustrates three phases associated with user communications using TDMA/DAMA on the UHF satellite network:

- Link set-up - User A requests a communications path to User B by sending an orderwire message to the controller. The controller assigns an idle time slot to the call and sends both User A and User B an orderwire message to use that time slot for communications.

- Communications - User A communicates with User B on the assigned time slot for as long as they need the communications path.

- Link release - When the communications between User A and B is completed, an orderwire message is sent to the controller indicating that the connection is no longer needed. The controller then makes the time slot available for assignment for other requests for service.
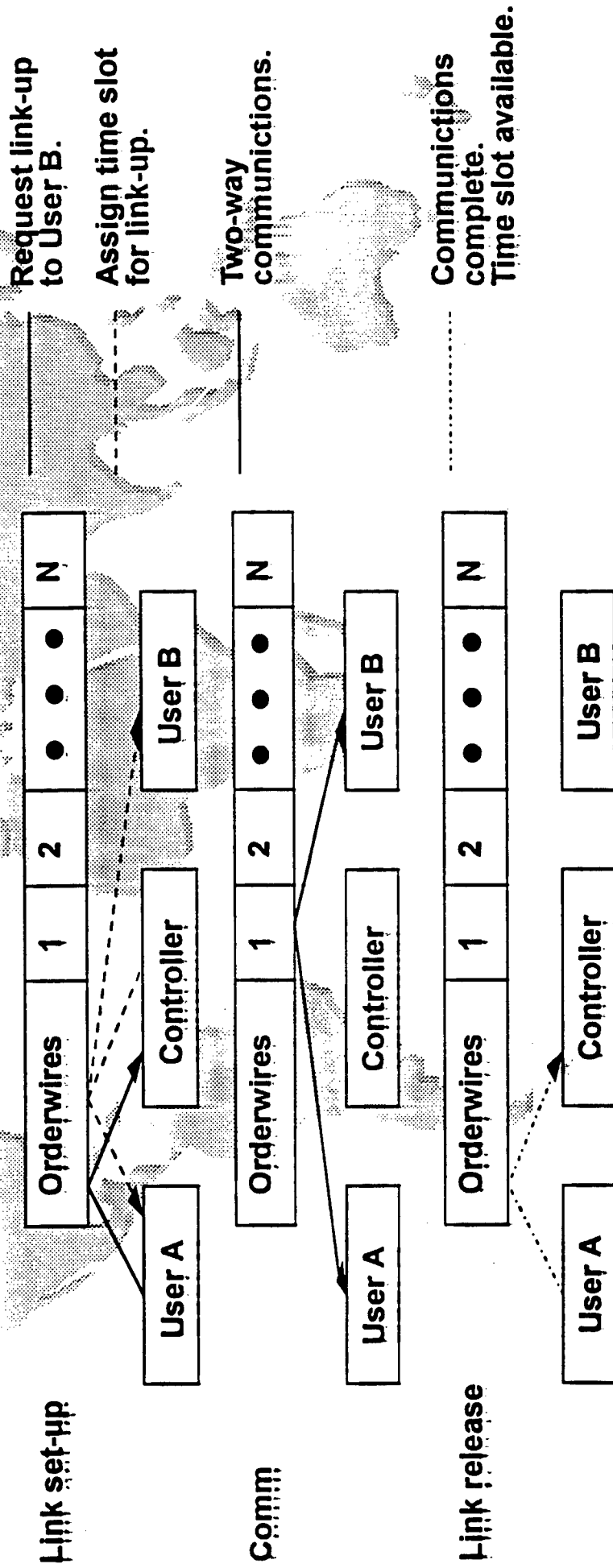
Since there is a pool of channels that can be divided into many communications paths (time slots), many users can be communicating simultaneously. And since they all do not need to communicate at the same time, many more can be served than if each net of users were assigned a dedicated communications path.

UHF SATCOM Standards
DAMA Principles:
"What is TDMA/DAMA?"

- **TDMA/DAMA**

IN TDMA, USER REQUESTS COMMUNICATIONS LINK-UP AND CONTROLLER ASSIGNS A TIME SLOT. USERS RELEASE TIME SLOT WHEN COMMUNICATIONS IS COMPLETE.

Link set-up

Orderwires	1	2	• • •	N

| User A | | Controller | | User B |

Request link-up to User B.

Assign time slot for link-up.

Comm

Orderwires	1	2	• • •	N

| User A | | Controller | | User B |

Two-way communictions.

Link release

Orderwires	1	2	• • •	N

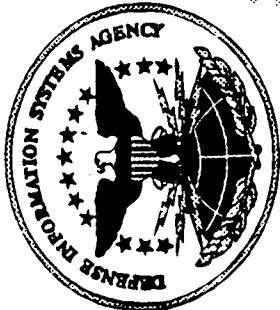| User A | | Controller | | User B |

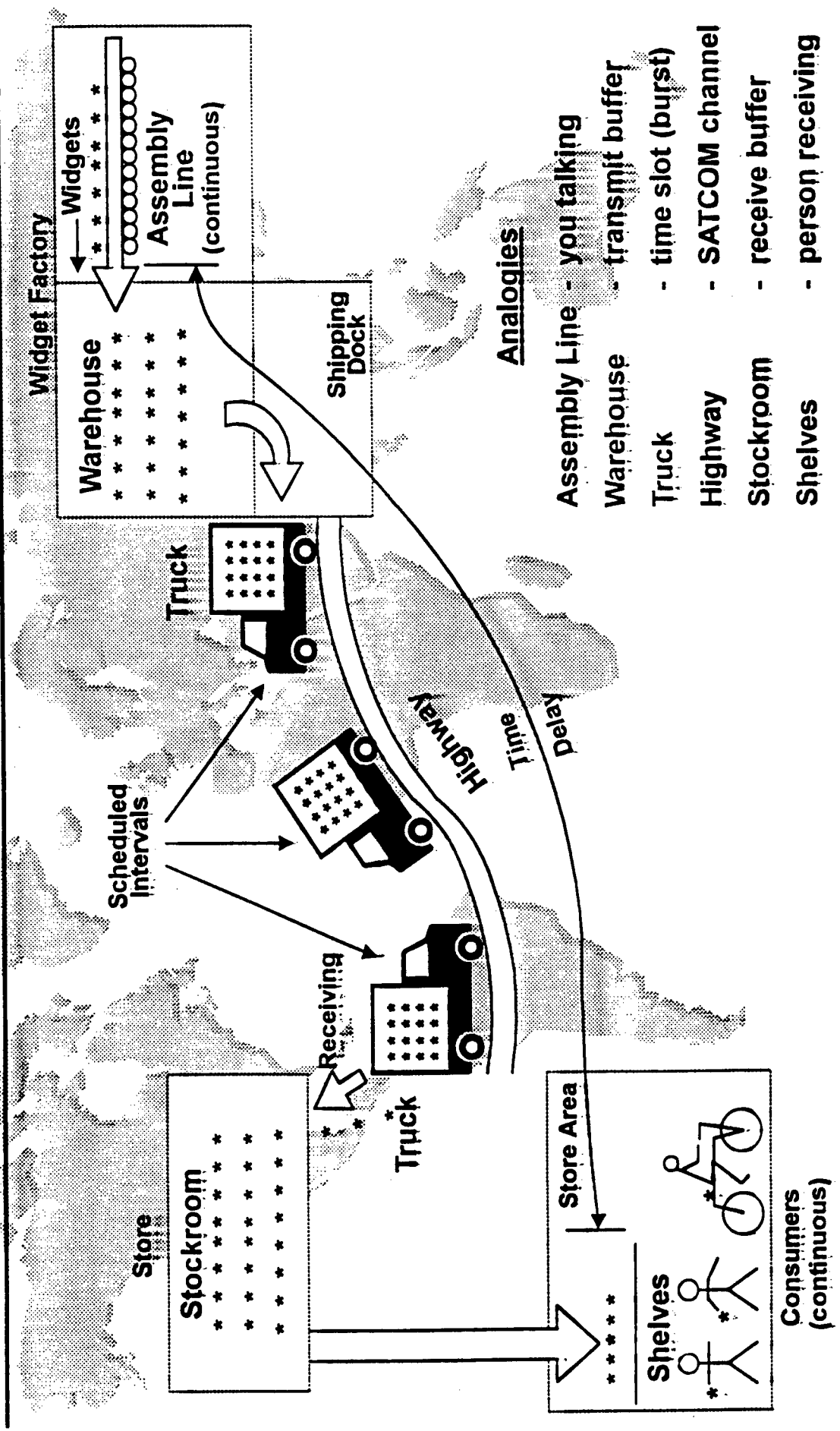Communictions complete. Time slot available.

9. TDMA EXAMPLE

As a nontechnical person, the last few slides may have been confusing. You read terms like multiple access, frame, orderwire time slot, and communications time slot, and you may have gotten lost after the first term. Let us take the example of tracking the manufacture and consumption of a widget. The widget is produced in a manufacturing plant on an assembly line, and the widgets are produced in a steady stream. The widgets are not shipped to the store where they will be sold to consumers on a continuous basis, but rather go into a warehouse or holding area until they are shipped at specifically timed intervals in accordance with a schedule. The widgets are loaded on a truck and transported to the store where they will be sold to consumers. They are unloaded into the store's warehouse and are moved to the store shelves as consumers purchase the widgets at a continuous rate, hopefully equal to or less than the manufacturing rate.

This widget supply model is very much the same as talking over a TDMA system. The widgets are your voice, which comes out on a continuous basis. The voice information is stored in the warehouse which we call a buffer. The buffer is then unloaded into the time slot or the truck, at a scheduled time interval which is analogous to the timing of the TDMA frame. The truck takes a highway, or communications channel, and arrives at the store, and the voice information is unloaded into the store warehouse, or the receive buffer. The voice information is then transferred to the shelves or a speaker where consumers (users) get a steady supply just as if they were standing at the end of the assembly line or your transmitter.

As you can see from the model, the truck and warehouses must be large enough to supply the needs of the consumers between delivery intervals; otherwise, out of stock periods would occur. Also, the time between shipment or the time interval determines the delay between when an item rolls off the assembly line and when it is actually delivered to the consumer. In the TDMA system, this is known as the waveform delay. The truck can be considered a time slot carrying information on the highway that the truck takes to the store. Many trucks (time slots) can use the highway at the same time, as long as they do not try to occupy the same place (time slot) at the same time. The highway is similar to the satellite channel where each burst or truckload is in sequence on its way to its destination on a schedule.

UHF SATCOM Standards
DAMA Principles:
TDMA Example

Widget Factory

Widgets

Assembly Line (continuous)

Warehouse

Shipping Dock

Truck

Scheduled Intervals

Highway

Time Delay

Receiving

Truck

Store

Stockroom

Shelves

Store Area

Consumers (continuous)

Analogies

Assembly Line - you talking
- transmit buffer

Warehouse - time slot (burst)

Truck - SATCOM channel

Highway - receive buffer

Stockroom - person receiving

Shelves

10. OVERVIEW OF 5-KHZ WAVEFORM

The 5-kHz waveform was designed primarily for Air Force data communications applications, as evidenced by the requirements in the waveform for acknowledgment of message packets and message complete messages. This slide illustrates the waveform frame structure adopted for 5-kHz. Each frame is 8.96 seconds long and consists of three segments:

A. **Forward Orderwire (FOW).** Consists of one variable-size time slot and is always located at the start of the frame. The FOW provides the means for the central controller to communicate with each earth terminal, and provides the data bits used by the earth terminals in the DAMA network to attain network synchronization. The controller transmits responses to user service requests and directs actions to the user earth terminals employing the FOW. The actual size of the FOW is determined by the central controller. The user earth terminals are advised of this size within a data field of the FOW. This notification is provided in each frame to define the size of the FOW in the succeeding frame. This size must be known by the user terminal to determine location of other time slots. Adaptive techniques will be employed by the central controller to determine whether previous FOW time-slot allocation within a frame was adequate, inadequate, or excessive for transmitting required messages.
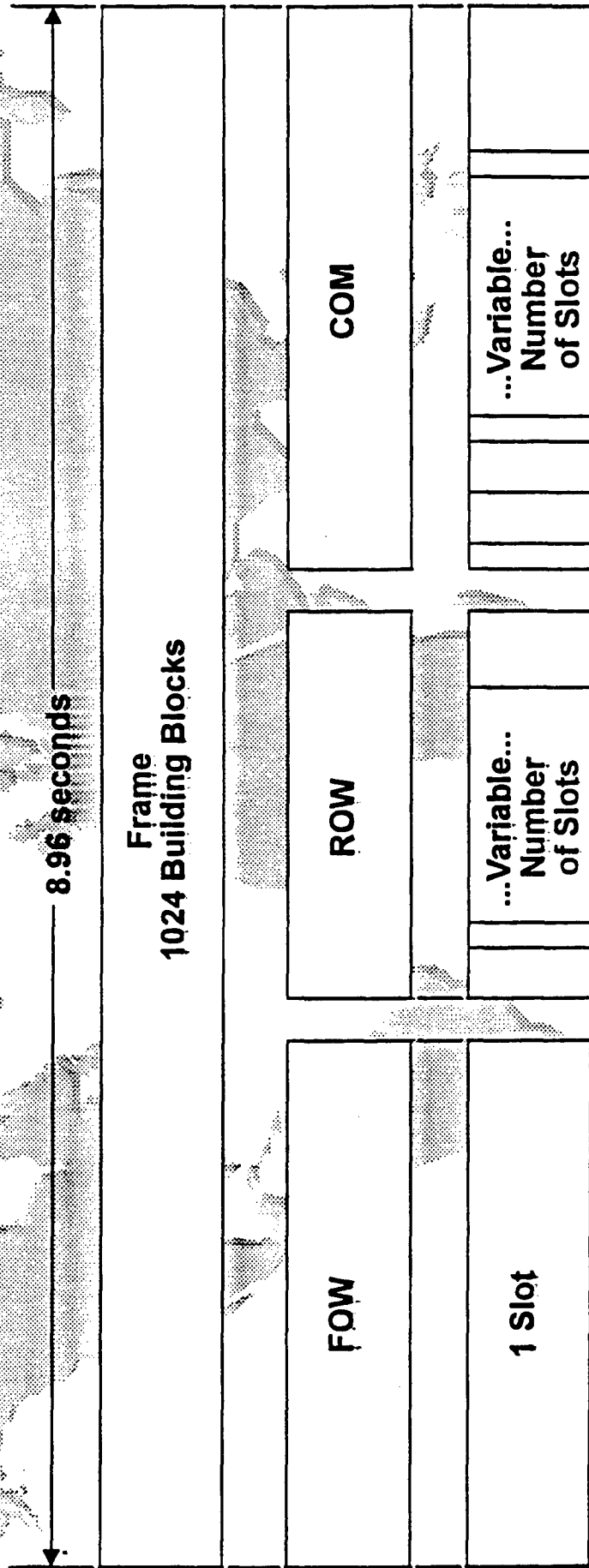
B. **Return Orderwire (ROW).** Composed of a variable number of time slots, and therefore is of variable length. These time slots permit the user earth terminals to communicate with the central controller as well as perform ranging and link tests. The ROW segment is composed of a variable number of time slots which are shared by the user earth terminals and time slots that are assigned by the central controller. These time slots are (a) Contention Ranging slots, a variable number of time slots allocated in each frame for the earth terminals to perform ranging operations periodically and when initially entering a DAMA network; (b) Contention Message slots, a variable number of time slots that are used to transmit messages to the central controller; (c) Assigned Ranging slots, a variable number of time slots assigned in each frame to specific terminals to perform ranging; and (d) Assigned Message slots, a variable number of time slots assigned to specific terminals to respond to central controller directions.

C. **Communications (COM).** Consists of time slots that vary in length and number based on traffic requirements. All of these time slots are assigned by the central controller, based on user service requests, and are employed by the user earth terminals to communicate among each other. The critical piece of information about the assignment of time slots in the 5-kHz waveform is that only the length of the time slot is allocated to a terminal. The time slots do not have a predefined start or stop time. The terminals must calculate where the start and stop time for their assigned time slot based on all time-slot assignment information in the previous FOW. At best, only one 2400-bps voice circuit can be provided in each frame.

The actual number of time slots allocated to each segment of the frame is determined by the central controller, based on traffic demands and the number of ROW retransmissions by the user earth terminals. The central controller can, therefore, change the allocation for each frame.

UHF SATCOM Standards
DAMA Principles:
Overview of 5-kHz Waveform

8.96 seconds

Frame
1024 Building Blocks

FOW	ROW	COM

| 1 Slot | ...Variable...
Number
of Slots | ...Variable...
Number
of Slots |

9

11. OVERVIEW OF 25-KHZ WAVEFORM

The 25-kHz waveform is organized as a repetitive frame with a 1.3866 second period, with two separate frame formats. Unlike the 5-kHz waveform, each segment of the 25-kHz TDMA frame is fixed. Also, within each of the user segments there is a fixed number of time slots. Frame Format 2 is depicted in the slide. It is divided into seven rate segments. Frame Format 1 differs from 2 in that the B segment is divided into two subsegments to eliminate contention for those half-duplex terminals (at RF) that require voice communications on two 2400-bps time slots. Frame Format 2 segments are:

A. **Channel Control Orderwire (CCOW)**. This segment is broadcast at the start of each frame and is used by the central controller to transmit commands to the user earth terminals, respond to service requests, and provide the information essential for earth terminals to attain synchronization.

B. **User Segments A, B, and C**. These segments are used for user-to-user traffic and have 16 different fixed formats in which they can operate. The format of the frame is defined in the CCOW master frame which occurs every eighth frame. Time slots within these segments are assigned by the central controller, based on service requests via the orderwire. Segment A can support data rates between 75 bps and 1200 bps, B can support data rates between 75 bps and 16 kbps, and C can support data rates between 75 and 2400 bps. The important fact to remember about the 25-kHz frame is that all formats are predefined and stored in the terminals. Time slots are defined as to ID number and start/stop timing. Therefore, when the controller tells a terminal to talk on a specific time slot, that slot always occurs at the same time relative to frame start time. The terminal, therefore, need not interpret the orderwire to be able to communicate on the time slot, once the time slot is assigned.
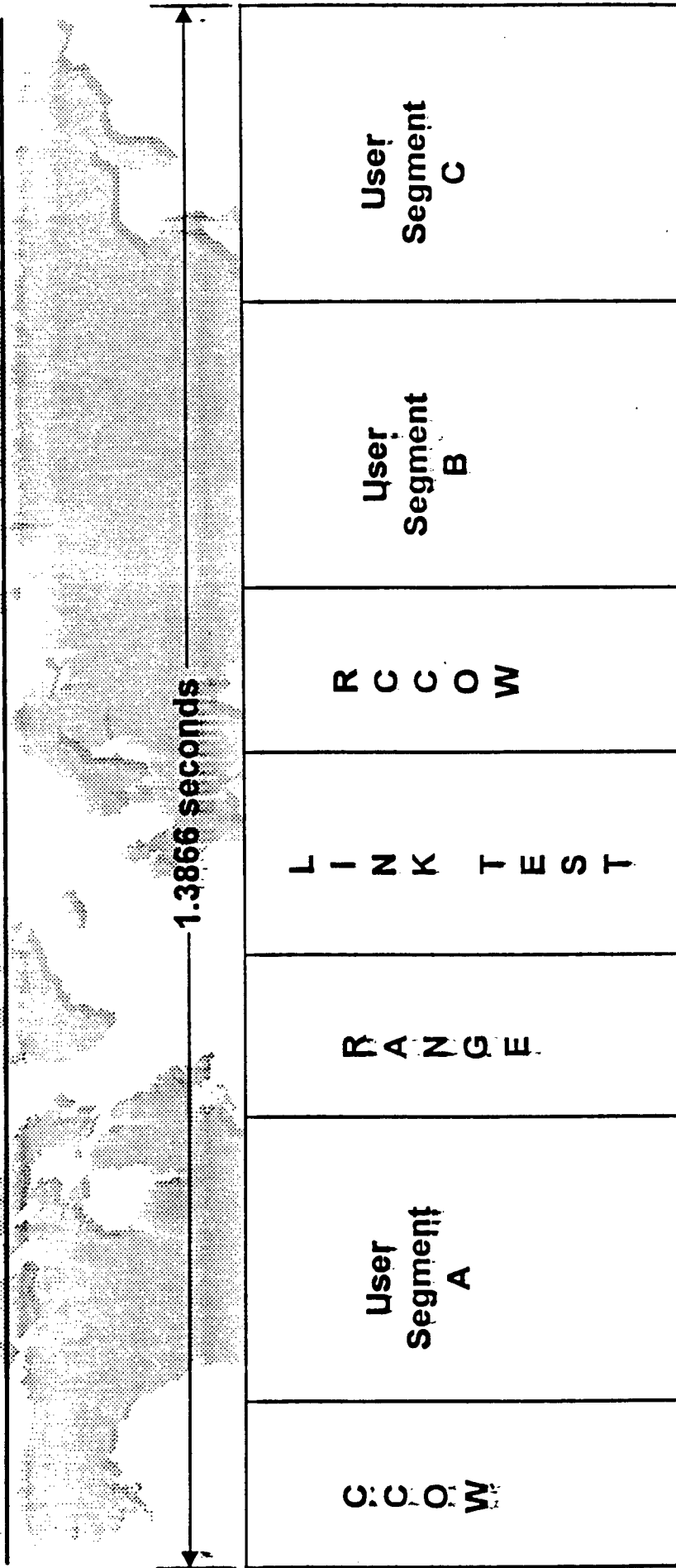
C. **Range**. This segment provides time slots used by user earth terminals to perform ranging operations. Ranging can be accomplished using transmission of ranging signals in shared time slots or the terminal may be assigned a dedicated time slot. Where active ranging is required, the terminal employs the shared time slots for initial entry into the DAMA network.

D. **Link Test**. This segment provides time slots for performing bit error rate tests to determine current operating conditions. A data stream is transmitted to the satellite and the return signal is used for this test. Time slots in this segment can be shared or can be dedicated to a specific terminal by the central controller.

E. **Return Channel Control Orderwire (RCCOW)**. This segment is used by the user earth terminals to transmit service requests to the central controller and respond to commands generated by the central controller.

UHF SATCOM Standards
DAMA Principles:
Overview of 25-kHz Waveform

1.3866 seconds

| C C O W | User Segment A | R A N G E | L I N K T E S T | R C C O W | User Segment B | User Segment C |

12. USER ISSUES

The UHF SATCOM user community has questioned the effectiveness of the 5-kHz waveform standard, since it's publication, in meeting their requirements. The operational community concerns expressed in several messages fall into the following five categories:

A. Waveform Acquisition Delay. This delay is the time it takes from when the terminal is powered-up until synchronization with the TDMA frame is attained. This delay is typically 27 to 36 seconds for 5-kHz TDMA/DAMA waveform operations.

B. Link Set-up Delay. This delay is the time it takes to establish a communications path between users, starting with the initiation of a service request. For the 5-kHz waveform, this time ranges from 18 to 27 seconds.

C. Push-to-Talk Delay. This delay is the time it takes for the spoken words at the transmit terminal to be received at the receive terminal. For the 5-kHz waveform this delay is approximately 9 seconds. For a voice net, this delay would cause an additional 18-second channel turnaround time. Channel turnaround time starts when User A says "OVER" until a response is received from User B.

D. Seamless Switching Between TDMA/DAMA Channels. The current design of the 5-kHz waveform does not permit a terminal, operating on a 5-kHz TDMA channel, to switch and operate on another 5-kHz or 25-kHz TDMA channel without delays. When switching to another TDMA channel, a terminal experiences waveform acquisition and set-up delays. With the current design, switching to a 5-kHz channel can typically take 45 to 63 seconds. Switching to a 25-kHz channel typically takes 15 seconds.

E. COMSEC Periods. Several users have expressed concerns that differences in the 5-kHz and 25-kHz DAMA waveforms will require different orderwire encryption keys. Such need will result in operational problems for users that have to operate over 5-kHz and 25-kHz channels. The number of keys required for DAMA orderwire encryption is strictly an operational security issue unrelated to the differences in the DAMA waveforms.

UHF SATCOM Standards
User Operational Issues
With 5-kHz Waveform

- Waveform acquisition delay - 27 to 36 seconds

- Link set-up delay - 18 to 27 seconds

- Push-to-talk delay - 9 seconds each way

- Seamless switching between TDMA/DAMA channels
  - To 5-kHz channel - 45 to 63 seconds
  - To 25-kHz channel - 15 seconds

- COMSEC periods

13. ALTERNATIVE OPTION 1

DEVELOP SHORT FRAME FOR VOICE (1/4 OF ORIGINAL) - LONG FRAME UNCHANGED

This briefing identifies three possible solutions that address the above user operational issues. To reduce the 5-kHz TDMA delays requires the use of a frame which has a shorter length and a fixed-frame format. Therefore, each of these solutions is based on having two frames for 5-kHz TDMA/DAMA operations. Channels configured to support small message communications will use the present TDMA frame and format. Channels set up to support voice or critical data communications will use a much shorter frame which has a fixed format. By implementing a fixed-frame format in the 5-kHz waveform, it will not be necessary any longer to operate the FOW at very low data rate. Therefore, it will require less overhead, allowing more traffic handling capacity.

Option 1 introduces a second 5-kHz waveform to support users who require voice or data communications that cannot be delayed. The new frame would employ a fixed-frame structure similar to the 25-kHz waveform. The existing 5-kHz waveform would be retained for short-message data communications. To accommodate critical users, a new waveform with a short frame equal to one quarter of the current 5-kHz waveform (2.24 sec) will be defined. It will use the same timing as the original waveform and operate in parallel with the original waveform. The new short waveform will operate with a newly defined, abbreviated FOW and ROW format. A limited subset of the current messages will be selected and revised as necessary to streamline the orderwire procedures. A fixed frame definition similar to the 25-kHz waveform will also be implemented to simplify waveform access and provide more robust communications capabilities in high error environments.
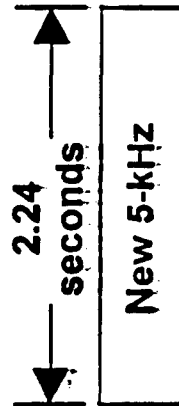
UHF SATCOM Standards Alternative Options: Option 1

1.3866 seconds
25-kHz

Voice and Data

8.96 seconds

Existing 5-kHz
for Data

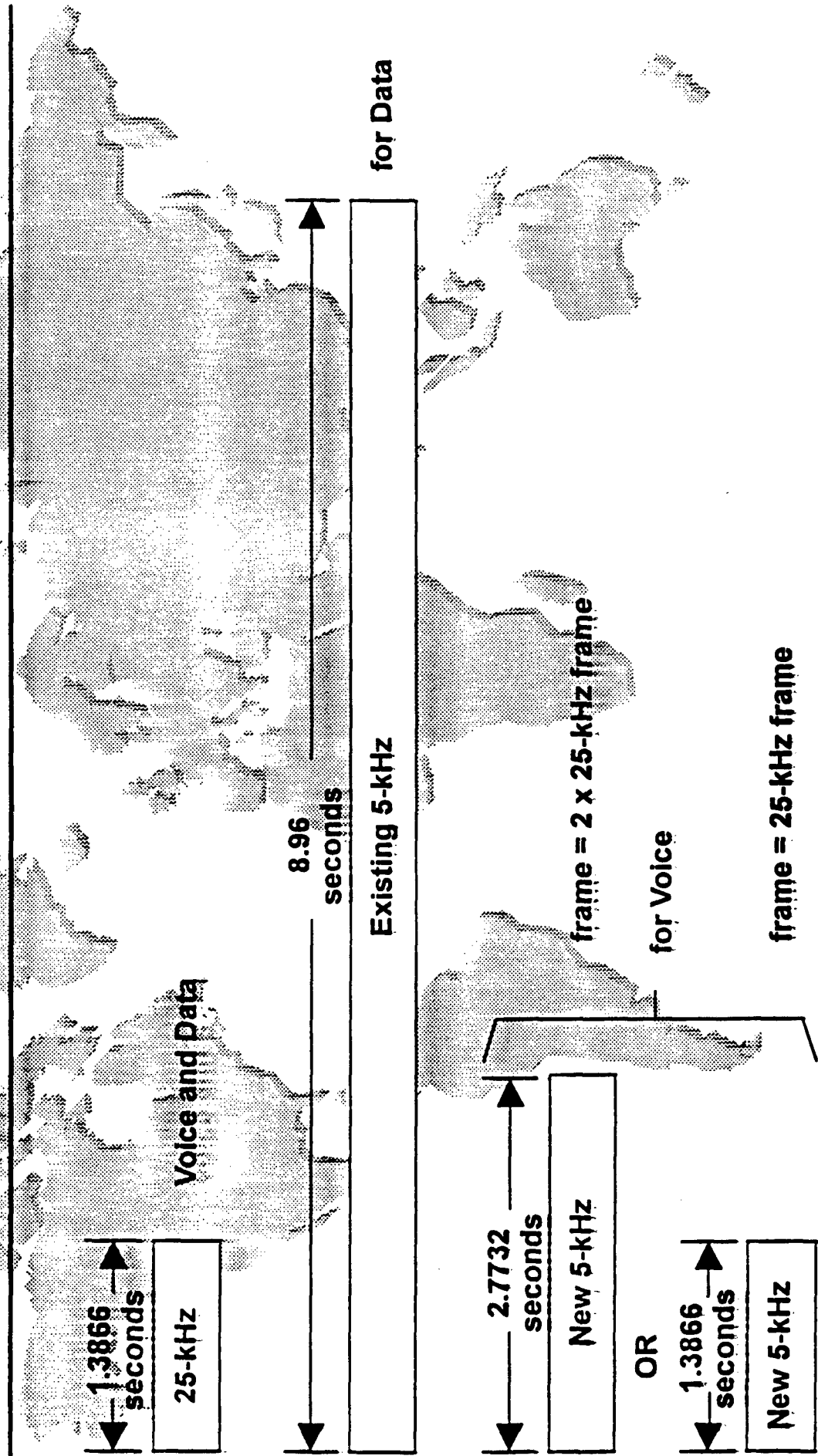2.24 seconds
New 5-kHz
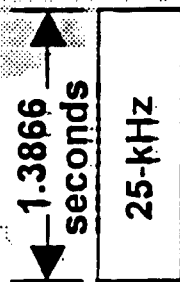
Voice

frame = 1/4 existing 5-kHz frame

13

14. ALTERNATIVE OPTION 2

DEVELOP SHORT FRAME FOR VOICE (EQUAL OR TWICE 25-kHz) - LONG FRAME UNCHANGED

This option is similar to the first option since it defines a new voice-only waveform for 5-kHz operation. The existing 5-kHz TDMA frame and format would be retained for short message data communications. The new frame would be used on channels supporting users who require voice or data communications which cannot be delayed. The new waveform consists of a short frame that is either equal to or twice the frame length of the 25-kHz waveform, depending on the achievable information rate for the advanced modulation techniques. The timing for the new 5-kHz waveform will be operated in synchronization with the 25-kHz waveform. The original 5-kHz waveform and protocols are retained for users in the data mode. The new short waveform will operate with a newly defined, abbreviated FOW and ROW format. A limited subset of the current messages will be selected and revised as necessary to streamline the orderwire procedures. A fixed-frame definition similar to the 25-kHz waveform will also be implemented to simplify waveform access and freewheeling capabilities in high error environments.
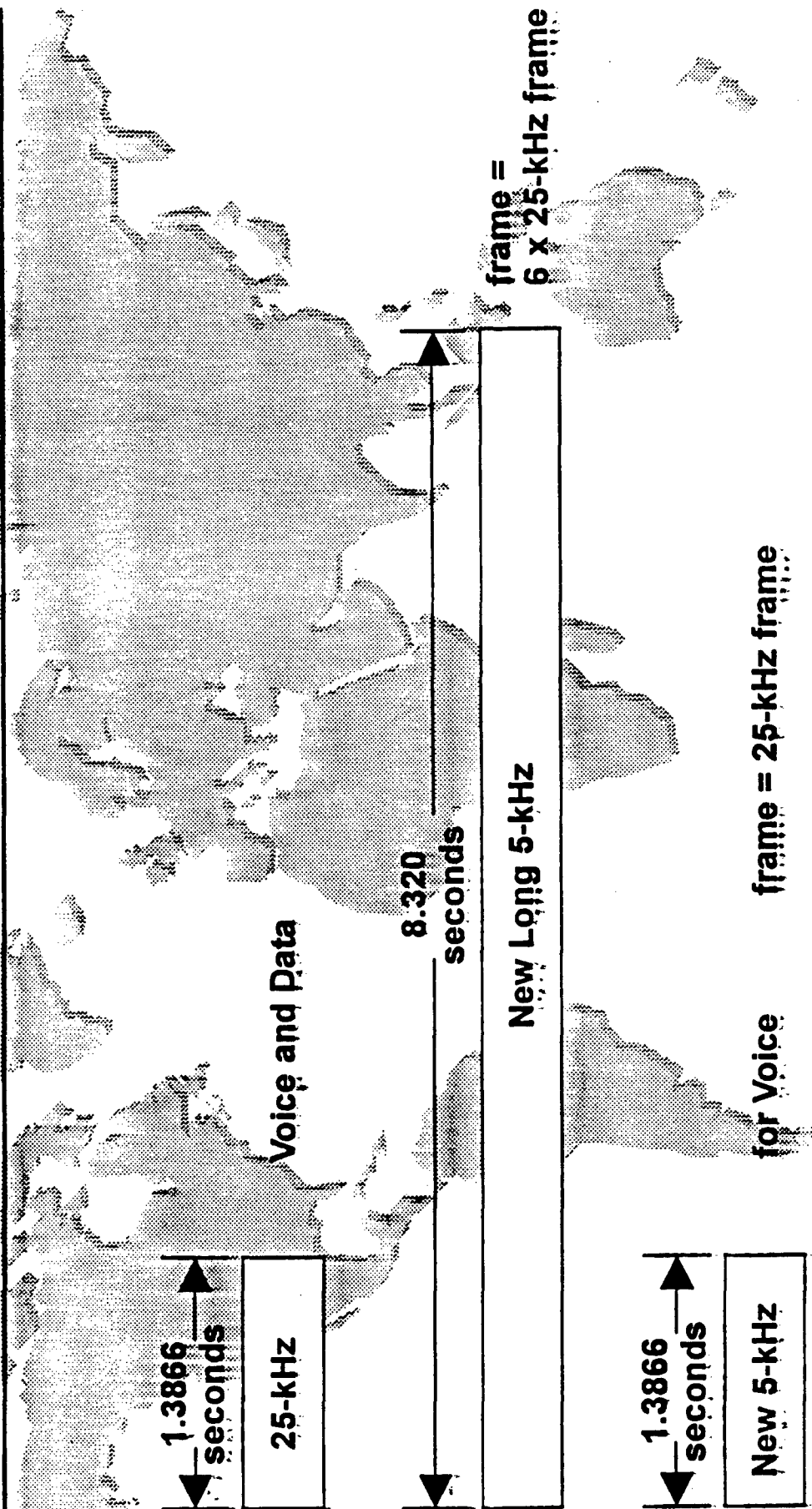
15. ALTERNATIVE OPTION 3

SHORT FRAME EQUAL TO 25-kHz FRAME - LONG FRAME SLIGHTLY SHORTER

This option proposes changing the existing 5-kHz waveform frame length to a multiple of the 25-kHz frame and operating a short frame waveform for critical voice and data users. The 5- and 25-kHz waveforms will operate in synchronization. The short frame waveform will be the same frame length as the 25-kHz waveform and have an abbreviated fixed-format orderwire and frame. A long frame waveform for data users that is 6 times the 25-kHz frame will be provided, using the original orderwire and frame scheme.

UHF SATCOM Standards Alternative Options: Option 3

Voice and Data

1.3866 seconds — 25-kHz

8.320 seconds

New Long 5-kHz

frame = 25-kHz frame

1.3866 seconds — New 5-kHz

for Voice

frame =
6 x 25-kHz frame

16. EVALUATION OF OPTIONS

The evaluation of the three possible solutions is presented with respect to three areas.

- Common Impacts - implementation impacts that all alternative options share

- Reduction of Delays - the extent to which each option reduces link set-up and push-to-talk delays

- Improvement of Channel Switching - the extent to which each option provides more expedient switching between 5- and 25-kHz channels.

UHF SATCOM Standards
Evaluation of Options:
Areas of Evaluation

- Common impacts
- Reduction of delays
- Improvement of channel switching
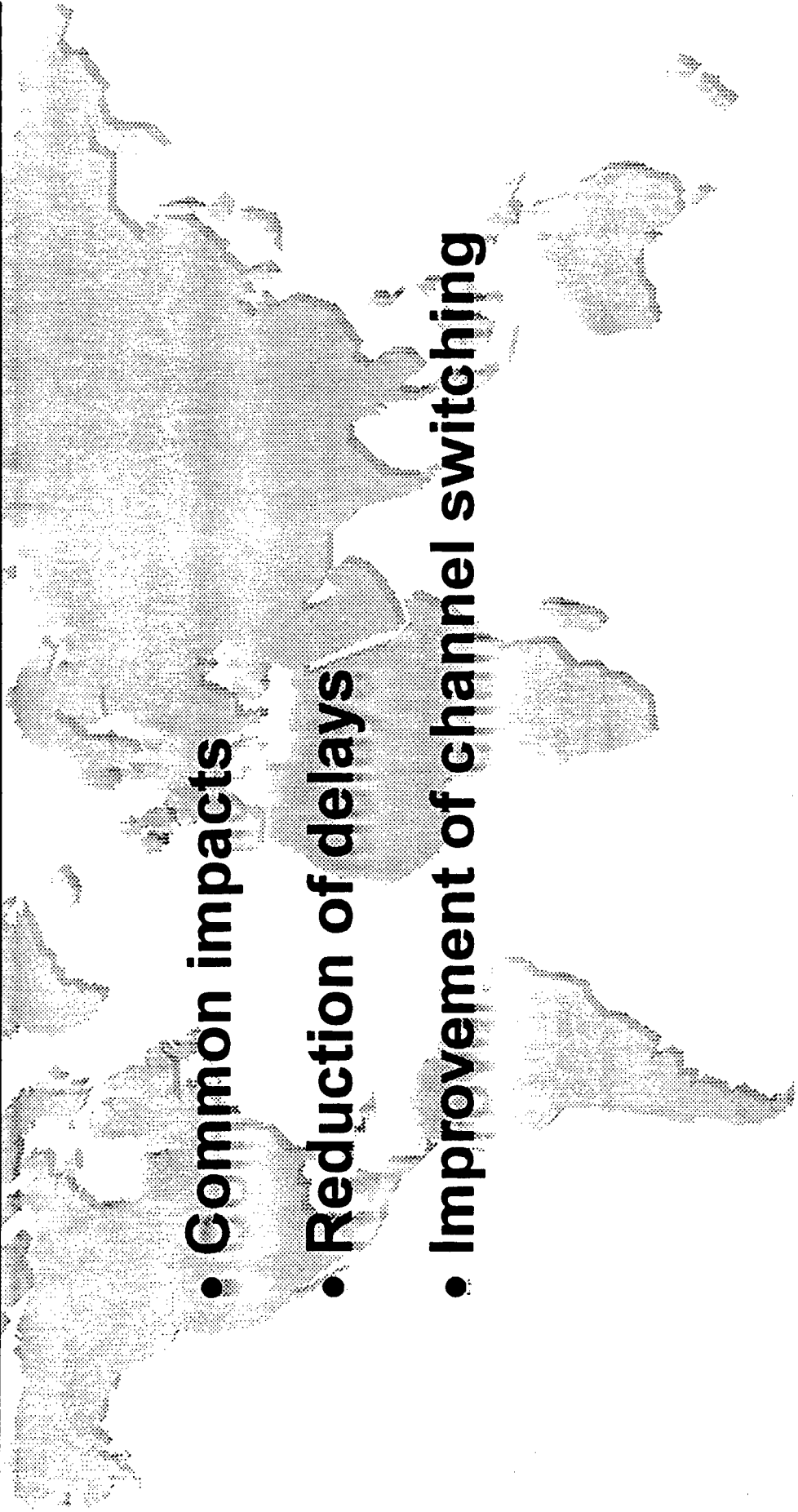
17. COMMON IMPACTS

Each of the options has four common impacts:

- Operationally, 5-kHz channels will have to be configured to operate in either a short or long frame in addition to dedicated or DASA modes. Channel allocation planners will have to deal with the additional balancing issue of how many are DAMA long, DAMA short, DASA, and dedicated.

- New orderwire messages development - The waveform standard must be revised   ine new control messages (5- and 25-kHz) to identify a new short frame mode.

- Upgrade those DAMA terminals that are to operate over the new frames, to change the timing and generate and respond to new orderwire messages.

- Incorporate new waveform into control system - Newly defined FOW/ROW formats and protocols must be integrated into the controller development and additional controller functions will be required to issue/receive orderwires at new short frame intervals.

UHF SATCOM Standards Evaluation of Options: Common Impacts

- Channel allocation balancing among short, long, DASA, and dedicated modes

- New control message and protocol development

- Earth terminal upgrades

- Integration of new waveform into system controller

18. REDUCTION OF DELAYS

This slide lists the delay reduction associated with each of the three options being considered. Each of the improvements noted is the result of reducing frame length. Note that all the times are shown in seconds.

UHF SATCOM Standards
Evaluation of Options:
Reduction of Delays

WAVEFORM	FRAME LENGTH	ACQUISITION DELAY	LINK SET-UP DELAY	PUSH-TO-TALK DELAY	SEAMLESS OPERATION
Existing (Voice/Data)	8.96	27 to 36	18 to 27	9	No
Option 1					
Short Frame (Voice)	2.24	7 to 9	4.5 to 6.6	2	5 to 5
Long Frame (Data)	8.96	27 to 36	18 to 27	N/A	No
Option 2					
Short Frame (Voice)	1.386 / 2.77	1.4 to 5.4	3.2 to 4.6	1	5 to 25
Long Frame (Data)	8.96	27 to 36	18 to 27	N/A	No
Option 3					
Short Frame (Voice)	1.386	1.5 to 2.7	3.2 to 4.6	1	Yes
Long Frame (Data)	8.320	25 to 32	16.5 to 25	N/A	Yes

19. CHANNEL SWITCHING

This slide depicts how each of the options enhances the capability of switching from one TDMA/DAMA time slot to another without having to reacquire synchronization. The enhancement relates to switching between and among 5- and 25-kHz channels. The improvement noted for Options 2 and 3 results from the ability to synchronize the 5- and 25-kHz TDMA frames. Synchronization is made possible because the two TDMA frames will be the same length or exact multiples thereof. Note that for Option 2, switching would not be feasible for the 5-kHz TDMA frame retaining the existing frame length.

UHF SATCOM Standards
Evaluation of Options:
Channel Switching

OPTION	CHANNEL-SWITCHING ENHANCEMENT
Option 1	Some Improvement Limited among 5-kHz channels only
Option 2	More Enhancement - 5-kHz TDMA short frame - to - 5-kHz TDMA short frame - 5-kHz TDMA short frame - to - 25 kHz TDMA
Option 3	Most Enhancement All 5-kHz and 25-kHz TDMA channels

20. FOLLOW-ON ACTIONS

The intent is to decide, by September 1995, which technical solution will be used. This briefing is the first step in reaching that decision. The plan is to ensure involvement of all interested parties in reaching this decision. Users will be briefed to ensure the selected solution resolves their concerns. The Service project managers will be involved to ensure the selected solution has the least impact on ongoing terminal and control system acquisitions. The final decision will take into consideration the results of a separate effort to define a more efficient modulation scheme referred to as Advanced UHF SATCOM Modulation (AUSM). AUSM will enhance the throughput capacity of each 5-kHz channel.

UHF SATCOM Standards
Follow-On Actions

- Technical solution decision by September 1995
  - This briefing is first step
  - Plan is to keep user involved

- Paramount importance that user concerns are resolved

- Service project managers will be involved to ensure least impact on ongoing terminal and control system acquisitions

- Final decision will incorporate results of Advanced UHF SATCOM Modulation (AUSM) effort for enhanced throughput capacity of 5-kHz channels

DRAFT

DEFENSE INFORMATION SYSTEMS AGENCY
JOINT INTEROPERABILITY AND ENGINEERING
ORGANIZATION (JIEO)
FORT MONMOUTH, NEW JERSEY 07703-5613

ASSESSMENT OF OPTIONS
FOR IMPROVING THE
5-KHZ UHF DAMA WAVEFORM

DRAFT

FOREWORD

This report has been prepared by the Joint Interoperability and Engineering Organization (JIEO), whose principal interest is to improve joint interoperability among command, control, communications, and intelligence (C3I) systems. JIEO prepared the report based on Military Communications-Electronics Board (MCEB) direction to address user operational issues with the 5-kHz ultra high frequency (UHF) demand-assigned multiple access (DAMA) waveform.

The report will be used to help UHF satellite communications (SATCOM) users understand the efficiency versus operational effectiveness trade-offs in the implementation of contemplated improvements to the 5-kHz UHF DAMA waveform. This understanding will enable users to actively participate in the design of the improved waveform. This report was prepared by Andreas Pappas, Jim French, and Frank Grausso.

FOR THE DIRECTOR:

Louis J. Pilla
Chief, Information Transfer
    Standards Department

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EXECUTIVE SUMMARY

ES-1 PURPOSE

The purpose of this report is to present optional technical approaches for resolving user community concerns with the UHF SATCOM 5-kHz TDMA/DAMA waveform (MIL-STD-188-182). This report is in direct response to Military Communications-Electronics Board and Joint Staff tasking to address these concerns (see Appendix E). The design of existing waveforms is discussed to provide a basis for understanding the technical aspects of the problem and to provide an insight into possible solutions. This report initiates the process for reaching a decision on what actions will be taken.

ES-2 USER CONCERNS

The UHF SATCOM user community has questioned the effectiveness of MIL-STD-188-182, since its publication, in meeting their requirements. Operational community concerns expressed in several messages (see Appendix D) fall into the following three categories:

A. Delays. Because of the need for synchronization and to store data bits for transmission at a later time, there is a delay inherent in TDMA/DAMA systems. In addition the need to exchange orderwire messages, to establish a communications path, introduces additional delays. These delays fall into three areas. Note that the waveform acquisition and link set-up delays, as defined below, are cumulative for establishing a communications path starting with terminal power-up. Once established in the DAMA network, the waveform acquisition delay is not a factor.

       1. <u>Waveform Acquisition Delay</u>. This delay is the time it takes from terminal power-up until synchronization with the TDMA frame is attained. This delay is typically 27 to 36 seconds for 5-kHz TDMA/DAMA waveform operations.

       2. <u>Link Set-up Delay</u>. This delay is the time it takes to establish a communications path between users, starting with the initiation of a service request. For the 5-kHz waveform, this time ranges from 18 to 27 seconds.

       3. <u>Push-to-Talk Delay</u>. This delay is the time it takes for the spoken words at the transmit terminal to be received at the receive terminal. For the 5-kHz waveform this delay is approximately 9 seconds. For a voice net, this delay would cause an additional 18-second channel turnaround time. Channel turnaround time starts when user A says "OVER" until a response is received from user B.

B.   Seamless Switching Between TDMA/DAMA Channels. The current design of the 5-kHz waveform does not permit a terminal, operating on a 5-kHz TDMA channel, to switch and operate on another 5-kHz or 25-kHz TDMA channel without delays. When switching to another TDMA channel, a terminal experiences waveform acquisition and set-up delays. With the current design, switching to a 5-kHz channel can typically take 45 to 63 seconds. Switching to a 25-kHz channel typically takes 15 seconds.

C.   COMSEC Periods. Several users have expressed concerns that differences in the 5-kHz and 25-kHz DAMA waveforms will require different orderwire encryption keys. Such need will result in operational problems for users who have to operate over 5-kHz and 25-kHz channels. The number of keys required for DAMA orderwire encryption is strictly an operational security issue unrelated to the differences in the DAMA waveforms.

ES-3 EXISTING TDMA FRAME CONSTRAINTS

Below are three 5-kHz TDMA/DAMA waveform features that result in all users' concerns:

A.   Length of the TDMA Frame. The length of the 5-kHz TDMA frame is the predominant cause of waveform acquisition, link set-up, and push-to-talk delays.

B.   Flexible TDMA Frame Format. The 5-kHz waveform is based on a flexible frame format. This flexibility was a design feature to allow dynamic adaption, on a frame-by-frame basis, to changes in communications traffic demands. As a result, each terminal must receive and interpret the forward orderwire (FOW), transmitted by the network control station, in each and every frame to determine where to transmit or receive during the next frame. Terminals that do not receive the FOW or receive it in error are prohibited from transmitting during the next frame.

C.   Different Frame Lengths. The lengths of the 5- and 25-kHz TDMA frames are different. Not only are they different, but they are not a multiple of each other. This difference requires a terminal to reacquire TDMA frame synchronization when switching to or from a 5-kHz channel.

ES-4 VALIDATED REQUIREMENTS

The JIEO strategy for improving the 5-kHz DAMA waveform was presented and approved by the USMCEB (Ref. A). During the briefing of the established strategy, JIEO requested that the Joint Staff establish the maximum acceptable delays of the improved waveform. The Joint Staff messages (see Appendix E) identify the objectives of the waveform improvements to *"drive the delay times down to the lowest level possible"* and establish the maximum acceptable waveform delays as follows:

- Frame duration to 2.25 seconds or less

- Call set-up time to 8 seconds or less

- Push-to-talk time to 2 seconds or less

ES-5 POSSIBLE SOLUTIONS

This report identifies three possible solutions that address the above user concerns. Reduction of the 5-kHz TDMA delays requires the use of a frame that has a shorter length and a fixed-frame format. Therefore, each of these solutions is based on having 2 frames for 5-kHz TDMA/DAMA operations. Channels configured to support small message communications will use the present TDMA frame and format. Channels set-up to support voice or critical data communications will use a much shorter frame, which has a fixed format. By implementing a fixed-frame format in the 5-kHz waveform, it will not be necessary any longer to operate the FOW at very low data rates. Therefore, it will require less overhead, allowing more traffic handling capacity.

A. **OPTION 1: Short Frame 1/4 of Existing Frame - Long Frame Unchanged.** The short TDMA frame of this option will be 1/4 the length of the existing 5-kHz waveform. This new frame would be used on UHF SATCOM channels configured to support users who require voice or data communications that cannot be delayed. The new frame would employ a fixed frame structure similar to the 25-kHz waveform. The existing 5-kHz waveform would be retained for short-message data communications.

B. **OPTION 2: Short Frame Equal to or Twice the 25-kHz Frame - Long Frame Unchanged.** The short TDMA frame of this option will be equal to or twice the length of the 25-kHz TDMA frame. As with Option 1, this option would use a fixed-frame structure similar to the 25-kHz waveform. The existing 5-kHz TDMA frame and format would be retained for short-message data communications. The new frame would be used on channels supporting users who require voice or data communications that cannot be delayed.

C. **OPTION 3: Short Frame Equal to the 25-kHz Frame - Long Frame Slightly Shorter.** As Option 2, the short TDMA frame of this option will be equal to the length of the 25-kHz TDMA frame and would employ a fixed-frame format structure. The long frame would have a frame length exactly 6 times that of the 25-kHz waveform (which is approximately 0.6 seconds shorter than the present 5-kHz frame). The long frame would employ the existing orderwire and frame format and would be used for data communications not affected by delays.

ES-6 EVALUATION OF OPTIONS

The following discusses the evaluation of the three possible solutions.

A. **Each of the Options Has Four Common Impacts.**

● Operationally, 5-kHz channels will have to be configured to operate in either a short or long frame in addition to dedicated or DASA modes. Channel allocation planners will have to address this additional balancing issue of how many are DAMA long, DAMA short, DASA, and dedicated.

● New orderwire messages development. The waveform standard must be revised to define new control messages (5- and 25-kHz) to identify a new short frame mode.

● Upgrade those DAMA terminals that are to operate over the new frames, to change the timing and generate and respond to new orderwire messages.

● Incorporate new waveform into control system. Newly defined FOW/return orderwire (ROW) formats and protocols must be integrated into controller development and additional controller functions will be required to issue/receive orderwires at new short frame intervals.

B. **Reduce Delays.** Table ES-1 lists the delay reduction associated with each of the 3 options being considered. Each of the improvements noted is the result of reducing frame length. Note that all the times are shown in seconds.

Table ES-1.   5-kHz Delays

WAVEFORM	FRAME LENGTH	ACQUISITION DELAY	LINK SET-UP DELAY	PUSH-TO-TALK DELAY	SEAMLESS OPERATION
EXISTING (VOICE/DATA)	8.96	27 to 36	18 to 27	9	NO
OPTION 1 SHORT FRAME (VOICE) LONG FRAME (DATA)	2.24 8.96	7 to 9 27 to 36	4.5 to 6.6 18 to 27	2 N/A	5 to 5 NO
OPTION 2 SHORT FRAME (VOICE) LONG FRAME (DATA)	1.386/2.77 8.96	1.4 to 5.4 27 to 36	3.2 to 4.6 18 to 27	1 N/A	5 to 25 NO
OPTION 3 SHORT FRAME (VOICE) LONG FRAME (DATA)	1.386 8.320	1.5 to 2.7 25 to 32	3.2 to 4.6 16.5 to 25	1 N/A	YES YES

Table ES-1 indicates that using only delay and seamless operation as criteria, option 3 is the option of choice. However, other factors, such as cost and operational requirements, must be considered before making a final choice.

C.   Channel Switching. Table ES-2 depicts how each of the options enhances the capability to switch from one TDMA/DAMA time slot to another without having to reacquire synchronization. The enhancement relates to switching between and among 5- and 25-kHz channels. The improvement noted for Options 2 and 3 results from the ability to synchronize the 5- and 25-kHz TDMA frames. This is made possible because the two TDMA frames will be the same length or multiples thereof. Note that for Option 2 switching would not be feasible for the 5-kHz TDMA frame retaining the existing frame length.

Table ES-2.   Enhancement in Capability to Channel Switch

OPTION	CHANNEL-SWITCHING ENHANCEMENT
1	**Minimal enhancement** will be provided, since the short 5-kHz TDMA frames will use a fixed-frame format. However, seamless operation will be limited to 5-kHz channels only.
2	**More enhancement** will be provided, since the short 5-kHz TDMA frame length is a multiple of the 25-kHz frame and both use a fixed-frame format. Therefore, seamless operation will also be between short-frame 5-kHz and 25-kHz TDMA channels.
3	**Most enhancement** will be provided, since both 5-kHz TDMA frames (short and long) are equal to or multiples of the 25-kHz frame.

ES-7 FOLLOW-ON ACTIONS

The intent is to decide, by the end of 1995, which technical solution will be used. This report is the first step in reaching that decision. The plan is to ensure involvement of all interested parties in reaching this decision. Users will be briefed to ensure the selected solution resolves their concerns. Service project managers will be involved to ensure the selected solution has the least impact on ongoing terminal and control system acquisitions. The final decision will take into consideration the results of a separate effort to define a more efficient modulation scheme referred to as Advanced UHF SATCOM Modulation (AUSM). AUSM will enhance the throughput capacity of each 5-kHz channel. The plan is to divide the tasks of waveform improvement decision into the following 4 steps:

1. Select the frame length and format of the improved waveform. (Technical and Operational impact)

2. Select the modulation and forward error correction (FEC) coding to be used for the improved waveform. (Technical impact only)

3. Select the services to be offered and the frame time slot configuration that will support these services. (Technical and Operational impact)

4. Select the orderwire messages to be used. (Technical impact only)

NOTE: The feasibility of implementing the revised 5-kHz waveform will be based on terminal program impacts and cost analysis.

1. INTRODUCTION

1-1 PURPOSE

The purpose of this report is to present the results of the development and assessment of alternative options for improving the 5-kHz UHF DAMA waveform to address several inherent operational issues. This document provides a tutorial of UHF SATCOM principles, a description of the operational concerns and alternative approaches to resolve these concerns.

1-2 BACKGROUND

The Joint Chiefs of Staff (JCS) has issued memorandum MJCS-63-89, updated by MCM-89-94, requiring all of the Services to be capable of UHF SATCOM DAMA operation by the end of FY 96. As this transition point approaches, organizations are asking for more information on the new DAMA system and how its implementation is likely to affect them. Several organizations have studied the implementation standards and are concerned with the projected call set-up times and communications delays that can occur when operating in the various DAMA modes. These concerns were voiced at the Military Satellite Communications (MILSATCOM) Users Conference 93-1.

As a result, a Joint Staff Tasking Memorandum was issued [Ref. A], Subject: Tasking Based on MILSATCOM Users Conference 93-1, dated 10 September 1993, directing that a tutorial be developed to address user concerns. The tutorial [Ref. B] presents information to help users understand exactly what capabilities are available with DAMA. It explains both sides of DAMA--the vast improvement in service as well as the operational drawbacks. All the operating modes that DAMA offers are addressed. How users' needs can be satisfied, as opposed to continuing with the current practice of providing only a limited number of users with single net per channel (dedicated) service, is illustrated. The tutorial was well received by the user community, because it offered a comprehensive explanation of the flexibility and benefits of the 5- and 25-kHz DAMA waveforms.

Additional concerns have been expressed that the inability to switch from one TDMA/DAMA channel to another without undue delay limits the operational applications of UHF SATCOM. This switching has been referred to as *seamless switching*. For purposes of this report, seamless switching is defined as the capability to switch from a time slot on a TDMA/DAMA channel to a time slot on another TDMA/DAMA channel without experiencing the delays experienced with the present waveforms. These delays can include logging out of one network, reacquiring the TDMA frame on a different channel, and logging in to the new network.

While the major concerns of users were in the area of voice services, the operational drawbacks of the 5-kHz waveform were of the highest concern. It became immediately evident that the 5-kHz waveform had to be improved to enhance operational suitability. Therefore, it was decided to prepare an assessment of improvement options for presentation to the user community, to enable a system to be designed with the proper balance of efficiency and operational effectiveness.

In developing the proposed improvements, a user-developer team approach has been adopted to preclude the design of an operationally deficient system. The original DAMA system was developed by systems and design engineers with the all-important objective of _efficiency_, since they knew that UHF resources were scarce and they needed to serve as many users as possible. The problem with this approach is that a very efficient system was designed, but at the cost of operational effectiveness, which is now realized, must be traded-off for efficiency. Therefore, to obtain the proper balance of efficiency and operational effectiveness, the user will be part of the team to provide input to design improvements to the 5-kHz waveform.

This report will present a number of viable alternatives to improving the waveform as well as the results of an assessment based on performance criteria that highlight the advantages and disadvantages of implementing each. The plan is to open the channels of communication with users, in designing a system that provides both efficiency and operational effectiveness through a user-developer team concept.

1-3 REFERENCES

The following references were used in the preparation of this technical report:

A. USMCEB MSG# R 060705Z JUN 94, SUBJECT: Summary of 31 May 94 United States Military Communications-Electronics Board Meeting

B. JTC3A Report, _Tutorial on Set-up and Communications Delays for all UHF SATCOM DAMA Modes of Operation_, Final Report, 20 June 1994

C. MIL-STD-188-182, _Interoperability Standard for 5-kHz UHF DAMA Terminal Waveform_, 18 September 1992

D. MIL-STD-188-183, _Interoperability Standard for 25-kHz UHF TDMA/DAMA Terminal Waveform_, 18 September 1992

E. USCINCSOC MSG# R 231300Z SEP 94, SUBJECT: UHF DAMA Meeting Results

F.   HQ ACC MSG, DTG R081840Z, June 1992, SUBJECT: JCS
Mandated Ultra High Frequency (UHF) Satellite Communications
(SATCOM) Requirements

G.   CDRSIGCEN MSG, DTG 041500Z, October 1993, SUBJECT:
5-kHz Demand-Assigned Multiple Access (DAMA) Call Set-up Delay

H.   USCINCSOC MSG, DTG 121800Z, October 1993, SUBJECT:
DAMA Time Delay

I.   USCINCSOC MSG, DTG 011605Z, August 1994, SUBJECT:
5-kHz DAMA Voice Fix

J.   USCINCSOC MSG, DTG 231300Z, September 1994, SUBJECT:
UHF DAMA Meeting Results

K.   USCINCPAC MSG, DTG 082000Z, September 1994, SUBJECT:
5-kHz DAMA Voice Fix for the Warfighter

L.   COMUSKOREA MSG, DTG 260226Z, October 1994, SUBJECT:
Warfighter DAMA Concerns

1-4 APPLICABILITY

This report applies to UHF SATCOM terminals operating over
5- and 25-kHz satellite transponders in accordance with UHF
SATCOM standards [Refs. C and D].

1-5 POLICY

This report was prepared by JIEO, based on MCEB direction,
to lessen the 5-kHz DAMA inherent delays for providing voice
services and to address other operational issues. It will be
used to help UHF SATCOM users understand the operational and
communications impacts of proposed improvements to the current
UHF SATCOM DAMA standard for 5-kHz satellite channels.

1-6 CHANGE PROCEDURES

Written recommendations or suggested changes to this
assessment should be submitted to:

         Joint Interoperability
           and Engineering Organization
         ATTN: JEBBC (Andy Pappas)
         Fort Monmouth, NJ 07703-5613

1-7 REPORT ORGANIZATION

This assessment is composed of four chapters that address
the following subject areas:

- <u>Chapter 1 - Introduction</u>. Provides purpose, background, references, applicability, policy, change procedures, and report organization.

- <u>Chapter 2 - UHF DAMA SATCOM Principles</u>. Provides a basic tutorial on UHF SATCOM DAMA concepts geared toward nontechnical audiences and addresses the 5- and 25-kHz waveforms and modes of communications.

- <u>Chapter 3 - User Operational Issues</u>. Presents user-identified operational problems including set-up and communications delays, waveform synchronization, COMSEC periods, and channel switching between 5- and 25-kHz waveforms.

- <u>Chapter 4 - Alternative Options Evaluation</u>. Presents descriptions of alternative options proposed to address operational issues and assesses each.

- <u>Chapter 5 - Next Steps</u>. Provides a proposed process for finalizing the selection of the technical solution to use concerns.

2 UHF DAMA SATCOM PRINCIPLES

The purpose of this chapter is to provide a basic tutorial on time-division multiple access (TDMA) satellite access and DAMA techniques that permit users to share satellite resources. The discussion is geared toward nontechnical readers, to provide an understanding of the technical aspects of TDMA/DAMA and how these techniques are applied to 5- and 25-kHz UHF SATCOM channels. Understanding the technical aspects of TDMA/DAMA is important to understanding the constraints that must be considered in developing options to respond to user concerns with the current system design.

2-1 OVERVIEW OF DAMA MODES

Although it is true that TDMA/DAMA standards define waveforms for operation on the UHF SATCOM channels that employ a technology called TDMA, these standards include provisions for operating in four different UHF SATCOM modes. These modes increase the flexibility in use of the channels to better respond to variable operational requirements. Below are the four modes available in future UHF SATCOM systems:

A. Dedicated Single Access. This access mode provides sole use of a satellite channel (5- or 25-kHz). These channels do not operate within the DAMA protocols and are not controlled by a central controller. Authority to operate in this mode is attained from the satellite system manager. This is the principal way UHF satellite channels are employed today.

B. Demand-Assigned Single Access (DASA). This access mode provides for temporary use of a satellite channel (5- or 25-kHz) by a user for a predetermined time. This dedicated use requires that a satellite channel be allocated for non-TDMA/DAMA operation. Unlike the dedicated single access, users request this mode of operation using the DAMA protocols (orderwire). Authority to operate in this mode is made by the central controller, based on user demands and management guidance. Management guidance includes any terminal restrictions and the priorities assigned to the user. This mode of operation is terminated either by the central controller upon expiration of the established time for which the user was authorized to use the channel, or the user authorized to use the channel, such as would occur upon call completion. The user terminal must be synchronized and operating with the TDMA waveform to request this service.

C. Dedicated Multiple Access. This access mode assigns a dedicated time slot within the TDMA frame for full-time use by a user. Permission to operate in this mode is a management responsibility while the actual assignment is accomplished within

the DAMA protocols. A user terminal must therefore be synchronized with the TDMA frame to request and use this service

D. **DAMA.** This mode provides users with a time slot based on demand. Requests for and assignment of the TDMA frame time slot is accomplished within the DAMA protocols. Time-slot assignment is temporary or until users have completed the required communications. User terminals must therefore be synchronized with the TDMA waveform.

User concern has been expressed that the warfighters actively engaged or under imminent threat of engagement should retain the highest priority channels, that is, dedicated single access or DASA. However, with the number of users projected to employ UHF SATCOM capabilities, the use of these two modes is envisioned to be the exception rather than the rule. To satisfy the requirement for predominant use of the DAMA mode by users, the DAMA mode has to accommodate the full range of capabilities. This mode will be the focus of further discussion in the report.

2-2 SATELLITE ACCESS PRINCIPLES

The SATCOM equipment at the satellite acts as a relay that receives user communications signals, translates the frequency, and retransmits this signal after amplification. There must be means to separate the user rf signals to allow multiple users to share a single satellite channel. The means to provide this separation that will be employed in future UHF SATCOM networks i TDMA.

TDMA separates user signals based on time. Using this technique each terminal takes turns transmitting. With proper system design, the user signals arrive at the satellite at different times and do not interfere with each other. Sharing c satellite channels is accomplished by assigning each terminal a time in which to transmit. As shown in Figure 2-1, each user must transmit precisely at the assigned time. To compensate for inaccuracies in terminal and central controller timing source, guard bands are provided. During the time that each user's signal is received at the satellite, it has exclusive use of the SATCOM bandwidth and power. This communications at a specified time is referred to as a *communications burst*. Assignment of transmission time for exclusive use by an earth terminal require that all earth terminals be synchronized.

A. **Synchronization Required.** For TDMA communications to occur, not only must the transmitting terminal transmit at a precise time, but the receiving terminal must be prepared to accept the communications that are precisely located in time. For this to occur there must be a means of synchronization withi the system. Figure 2-2 depicts how each earth terminal (ET) mus transmit at the proper time for its signal to arrive at the satellite in the proper sequence. As shown, time slots have bee
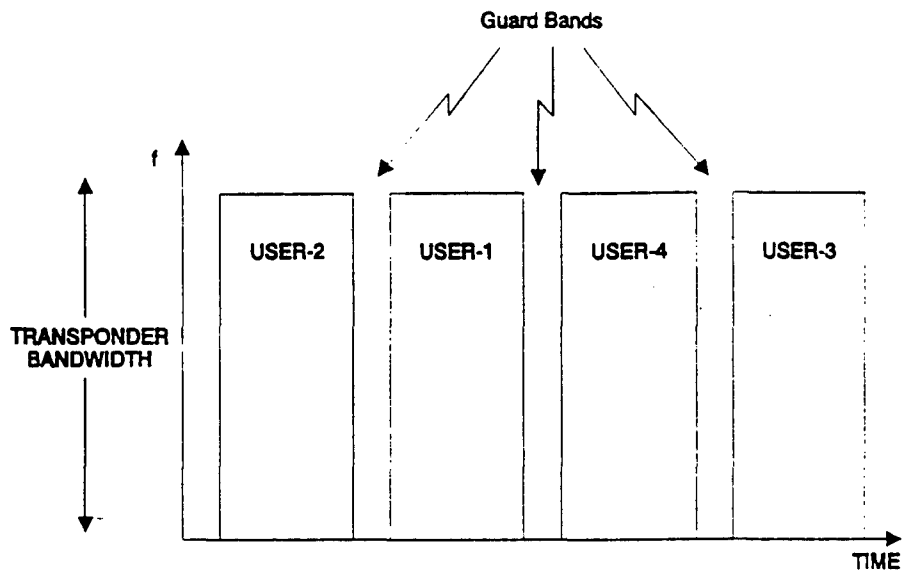
Figure 2-1. TDMA Satellite Transponder Access

assigned for satellite processing in the sequence ET-2, ET-1, ET-4, and ET-3. If either of the transmitting earth terminals is not synchronized, the communications signals will collide.
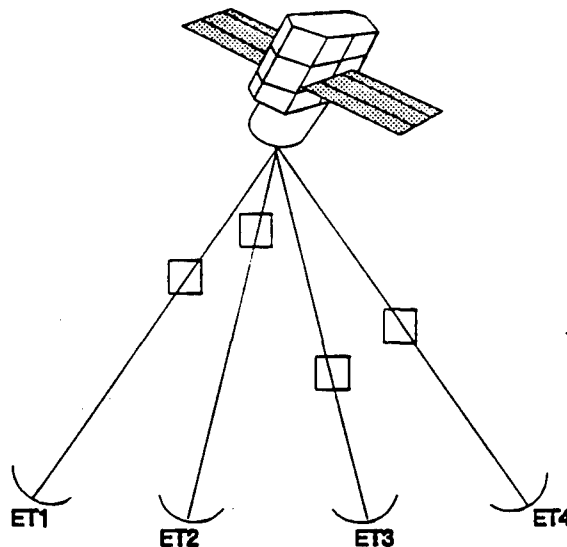
Figure 2-2. TDMA Synchronization

    B.   **TDMA Frame.** The means employed to synchronize the system is the transmission of a TDMA frame by a central controller, which defines system time. Figure 2-3 depicts a general TDMA frame. The segments of this frame are defined as follows:

| OW₁ | OW₂ | Burst for ET₂ | Burst for ET₁ | Burst for ET₄ | Burst for ETₙ |
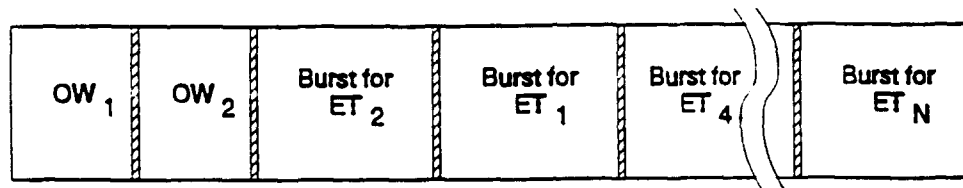
Figure 2-3. General TDMA Frame Structure

1. Orderwire (OW₁). This segment of the frame provides communications path for the central controller to transmit messages to user earth terminals. These messages include responses to service requests and instructions to be implemented by the earth terminals. Also included are data bits, referred t as the *synchronization preamble*, which permit the earth terminal to achieve receive timing or frame lock.

2. OW₂. This segment of the frame provides a communications path for the user earth terminals to transmit messages to the central controller. These messages include service requests and responses to central controller commands. Included in these messages are synchronization preamble data bit that permit the central controller to attain bit synchronization.

3. Burst for ET. This segment of the frame provides a path for user-to-user communications. Included in these communications are synchronization preamble data bits that permit the receiving terminals to attain bit synchronization.

Also included in a frame structure are separately assigne time slots for ranging and performance of link tests. These slots may be located within one of the segments noted in Figure 2-3, or there may be separately assigned segments.

C. **Synchronization Actions.** How does a UHF user terminal attain this synchronization with the TDMA frame when remotely deployed? To attain this synchronization each earth terminal must accomplish the following steps:

1. Acquire and Interpret Orderwire. This action, known as *downlink acquisition*, is required to align terminal receive timing with the central controller. The terminal must receive and interpret the orderwire transmitted from a central controlle to attain downlink acquisition. This interpretation encompasses detecting special data bits that permit the terminal to read the orderwire transmitted from the central controller. This acquisition permits the terminal to determine location of time slots throughout the frame, including those time slots available to perform ranging, login, and requesting service, all of which are required to initiate operations.

2. <u>Ranging</u>. This action, known as *uplink acquisition*, must be completed to determine the distance to the satellite. This distance is essential for the terminal to calculate transmit time for all transmissions. Those terminals able to determine satellite range by other methods can bypass this step.

D. **Separate TDMA Frame for Each Satellite Channel**. Each satellite channel will have a distinct TDMA frame. Each terminal assigned for DAMA operation has to synchronize with the TDMA frame on the satellite channel to which it has been assigned. Switching to another rf channel will require resynchronization with the different TDMA frame.

E. **Time Delays in Communications**. Since there is not a continuous stream of information (bits) flowing over the network, but, rather, bursts of information during a time slot, a means to store information between bursts is required. This storage procedure is called *buffering*, and it works as illustrated in Figure 2-4. As a user is speaking into his handset, his voice is being converted into a data bit stream at 2.4 kbps. In the example the TDMA frame contains four user communications time slots. One of these time slots is assigned for voice communications. Thus, each time slot is 1 second long. The voice communications is burst during the assigned time slot or 1 second out of 4. Note that in the figure one of the time slots in the frame is being used for orderwire communications. Before the burst can occur, the data bits must be stored, so that when the assigned time slot occurs, the data bits can be transmitted.

For this example, 4 seconds' worth of information from the user is transmitted in a 1-second interval. A storage device (buffer) capable of storing 4 seconds' worth of speech is required. At the 2.4-kbps rate of the data stream, this buffer would have to store 4 times 2.4 kbps or at least 9.6 kbps. When the assigned time slot occurs, everything in the buffer that amounts to 9.6 kbps is transmitted. Therefore, in order to burst all information bits, the data has to be transmitted at a rate of 9.6 kbps.

The effect of this buffering procedure causes what is known as *waveform delay*. The delay is equal to the length of the TDMA frame. Therefore, the delay experienced would be 4 seconds in the example.

2-3 LAYMAN'S VIEW OF TDMA

As a nontechnical person, the reader may have found the last section confusing. You read terms like *multiple access*, *frame*, *orderwire time slot*, and *communications time slot*, and you may have gotten lost after the first term. Let us take the example of tracking the manufacture and consumption of a widget. The widget is produced in a manufacturing plant on an assembly line and the widgets are produced in a steady stream. The widgets are

Speaker

Begin speech

Buffer loading

| 2.4 | 2.4 | 2.4 | 2.4 | 9.6 Kb stored

| OW | 1 | 2 | 3 | OW | 1 | 2 | 3 | OW | 1 | 2 | 3 |

← 1 frame →

9.6 kbps burst
sent
Speaker
buffer unloads

Receiver

| OW | 1 | 2 | 3 | OW | 1 | 2 | 3 | OW | 1 | 2 | 3 |

| 2.4 | 2.4 | 2.4 | 2.4 |

Waveform
delay

Receiving buffer
receives and
plays out speech

Speaker
began

Beginning of speech heard by receiver

Legend:

OW   - orderwire slots
1, 2, 3   - communications time slots
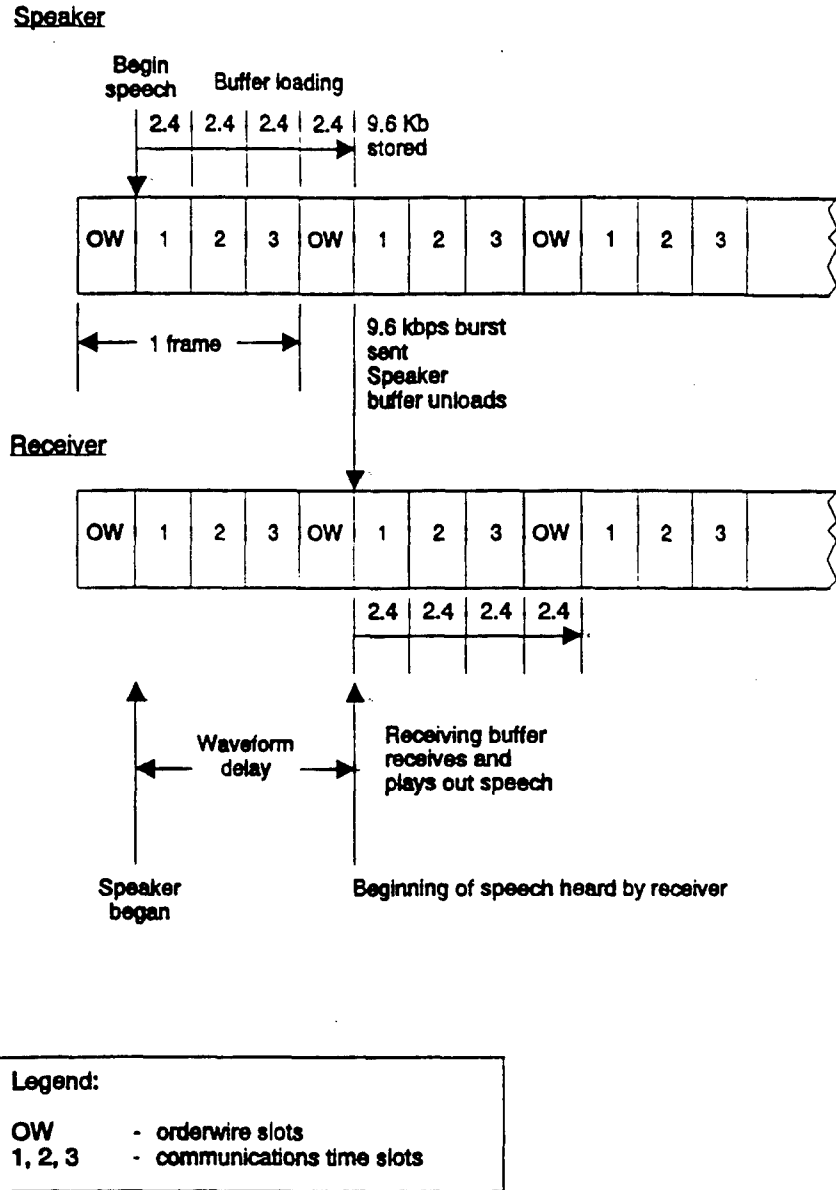
Figure 2-4. Waveform Delay

not shipped to the store where they will be sold to consumers steadily, but rather go into a warehouse or holding area until they are shipped at specifically timed intervals in accordance with a schedule. The widgets are loaded on a truck and transported to the store where they will be sold to consumers. They are unloaded into the store's warehouse and are moved to th store shelves as consumers purchase the widgets at a continuous rate, hopefully equal to or less than the manufacturing rate.

This widget supply model is very much the same as talking over a TDMA system. The widgets are your voice, which comes out continuously. The voice information is stored in the warehouse, which we call a *buffer*. The buffer is then unloaded into the transport system, the truck, at a scheduled time interval, which is analogous to the timing of the TDMA frame. The truck arrives at the store and the voice information is unloaded into the store warehouse, or the *receive buffer*. The voice information is then transferred to the shelves where consumers can get a steady supply just as if they were standing at the end of the assembly line.

As you can see from the model, the truck and warehouses must be large enough to supply the needs of the consumers between delivery intervals; otherwise, out-of-stock periods would occur. Also, the time between shipment or the *time interval* determines what the delay is between when an item rolls off the assembly line and when it is actually purchased. In the TDMA system, this is known as *waveform delay*. The time the truck leaves for the store can be considered a time slot on the highway that the truck travels to the store. Many trucks can use the highway at the same time, as long as they do not try to occupy the same place (time slot) at the same time. The highway is similar to the satellite link, where each burst or truckload is in sequence on its way to its destination on a schedule.

2-4 USER ACCESS WITH TDMA/DAMA

The coupling technique to be employed in future UHF SATCOM networks to connect a user transmission to a TDMA time slot is demand-assigned multiple access (DAMA). The term *DAMA* can be viewed in two parts. The assignment of user access to satellite resources based on demand is the first part; thus, the term *demand assigned*. Since many users can share or access a satellite channel at the same time via multiple time slots, the system is said to have *multiple access*, which refers to the second part. The multiple-access technique for UHF SATCOM is TDMA; thus, the term *TDMA/DAMA*. This demand-assigned sharing allows many more users to access satellite channels, because channel time slots are used only when a terminal is actually talking on it, and released for other users when it is finished talking. This method reduces the idle time on a channel significantly, and makes the SATCOM system much more efficient.

The users within a UHF SATCOM system are connected to a specific port of an earth terminal. The earth terminal receives the data (message or digital voice) at the specific user port and processes it for transmission within a TDMA time slot. The user could be connected to the TDMA time slots on a dedicated basis. This dedicated connection, however, would not permit sharing of the assigned time slot in near-real time. Sharing of the time slots based on need or demand requires that a time slot connection be made only for the duration of use by a specific

user and assigned to another user when the time slot is no longer in use.

The assignment of time slots based on demand requires a control system capable of processing service requests, determining whether the request can be satisfied, assigning available time slots to service the request, and conveying the assignment to the calling and called parties. Thus, the time-slot assignment is accomplished dynamically. Figure 2-5 depicts the flow of messages between the user terminal and the central controller to establish a communications path between two users. Each action to establish a communications path is defined as follows:
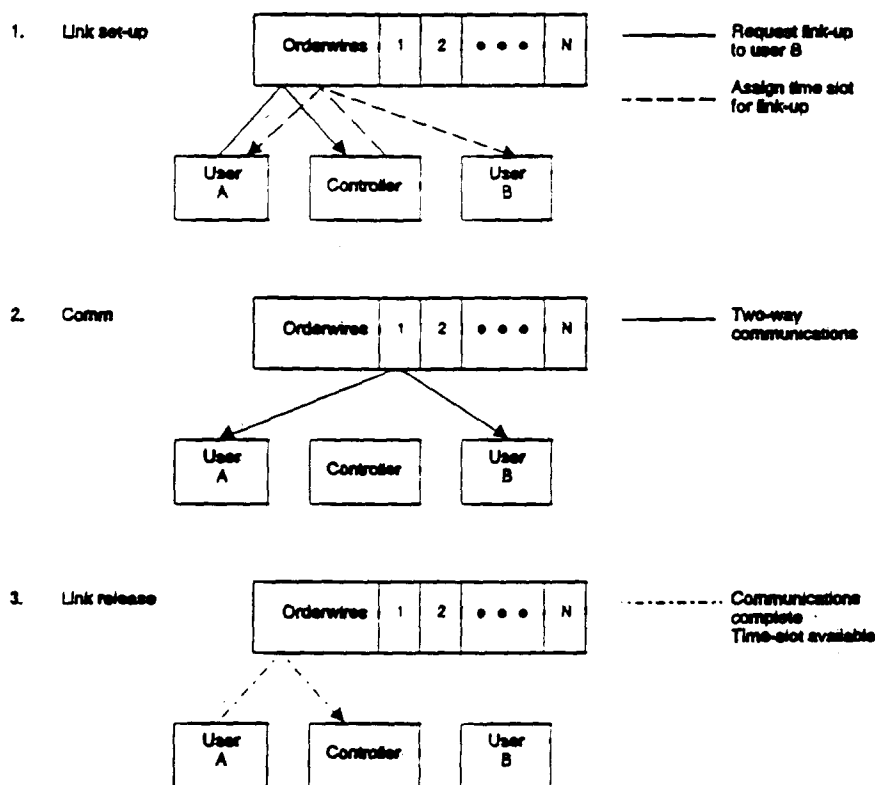
Figure 2-5. UHF SATCOM TDMA/DAMA Concept

A. Link Set-up. The initial step is for the calling-user earth terminal to transmit a service request orderwire message t the central controller. This transmission is done within a designated orderwire segment of the TDMA frame. Upon receipt of this request the central controller locates available time slots that can be employed for the communications service. When the central controller locates the time slot, an orderwire message i transmitted to the calling and called party, identifying the tim slot(s) to be used for the requested communications. This

orderwire transmission is done within a designated orderwire
segment of the TDMA frame.

   B. Communications. Upon receipt of the orderwire message
from the controller, the calling party (user A) communicates with
the called party (user B) in the assigned time slot(s). These
transmissions are done within designated communications segments
of the TDMA frame.

   C. Link Release. When communications between user A and B
are completed, an orderwire message is transmitted to the central
controller so advising. This transmission is done within a
designated orderwire 2 segment of the TDMA frame discussed above.
The central controller notes the time slots as unused and
available for assignment to another service request.

2-5 OVERVIEW OF 5-kHz TDMA WAVEFORM

   The 5-kHz waveform was designed primarily for data
communications, specifically for Air Force applications, as
evidenced by the requirements in the waveform for acknowledgment
of receipt at the destination of message packets and total
messages. The waveform frame structure adopted for the 5-kHz is
depicted in Figure 2-6. Each frame is 8.96 seconds long, and
consists of 3 segments, described as follows:
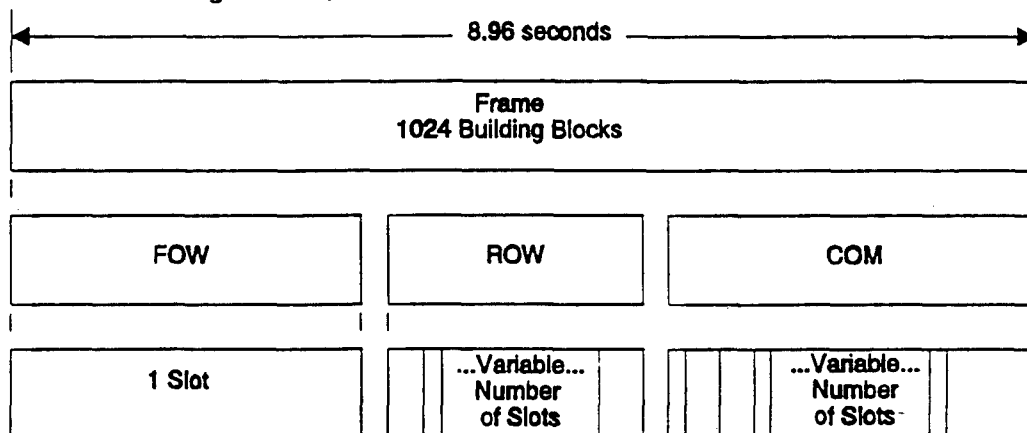
Figure 2-6. 5-kHz Frame Format

   A.   Forward Orderwire (FOW). This segment consists of one
variable-size time slot and is always located at the start of the
frame. The FOW provides the means for the central controller to
communicate with each earth terminal, and provides the data bits
used by the earth terminals in the DAMA network to attain network
synchronization. The controller transmits responses to user
service requests and directs actions to the user earth terminals
employing the FOW. The actual size of the FOW is determined by
the central controller. The user earth terminals are advised of
this size within a data field of the FOW. This size notification

is provided in each frame to define the size of the FOW in the succeeding frame. The size must be known by the user terminal tc determine the location of other time slots. Adaptive techniques will be employed by the central controller to determine whether previous FOW time-slot allocation within a frame was adequate, inadequate, or excessive for transmitting required messages. The FOW size can therefore change from frame to frame.

   B.   Return Orderwire (ROW). This segment follows the FOW segment and is composed of a variable number of time slots. The length of the ROW is therefore variable. These time slots permit the user earth terminals to communicate with the central controller, as well as perform ranging and link tests. The ROW segment is composed of a variable number of time slots shared by the user earth terminals and time slots assigned by the central controller. These time slots are defined as follows:

   1.   Contention Ranging. The central controller allocates a variable number of time slots, in a frame, for the earth terminals to perform ranging operations. The number of these time slots allocated in the next ROW is identified in each FOW. These time slots are shared by each earth terminal and are the time slots used by the earth terminals to perform ranging when initially entering a DAMA network. The number of time slots allocated in each frame is based on network activity requiring initial DAMA system entry.

   2.   Contention Message. Within the ROW segment are a variable number of time slots used to transmit messages to the central controller. The number of these time slots in each frame is based on traffic requirements. These time slots are shared by the user earth terminals and are used to forward the initial ROW message to the central controller. This type of time slot is used to transmit initial service requests to the central controller.

   3.   Assigned Ranging. Within the ROW segment are a variable number of time slots assigned in each frame to specific terminals to perform ranging. These time slots are assigned by the central controller, based on requests received from the terminals, and automatically assigned at least every 4.5 hours t: each terminal. These assignments are made in each FOW.

   4.   Assigned Message. Within each ROW are a variable number of time slots assigned to specific terminals to respond t central controller directions. For example, if the controller requests a status report, the FOW transmitting this request woul. include designation of the time slot to be used by the terminal for responding via the ROW. The number of these time slots in each frame are based on the number of requests generated by the central controller.

C. **Communications (COM).** This segment consists of time slots that vary in length and number. The variable length is based on traffic requirements. All of these time slots are assigned by the central controller, based on user service requests and other network activity. These are the time slots employed by the user earth terminals to communicate among each other. The critical piece of information about the assignment of time slots in the 5-kHz waveform is that only the length of the time slot is allocated to a terminal. The time slots do not have a predefined start or stop time. The terminals must calculate where to start and stop time for their assigned time slot based on all time-slot assignment information in the previous FOW. At best, only one 2400-bps voice circuit can be provided in each frame.

The actual number of time slots allocated to each segment of the frame is determined by the central controller, based on traffic demands and the number of ROW retransmissions by the user earth terminals. The central controller can therefore change the allocation for each frame. Additional details on the TDMA frame structure is included in Appendix B.

2-6 OVERVIEW OF 25-kHz WAVEFORM

The 25-kHz waveform is organized as a repetitive frame with a period of 1.3866 second, with two separate frame formats. Unlike the 5-kHz waveform, each segment of the 25-kHz TDMA frame is fixed. Also, within each of the user segments is a fixed number of time slots. Frame Format 2, depicted in Figure 2-7, is divided into 7 separate segments. Frame Format 1 differs from what is depicted in Figure 2-7 in that the B segment is divided

<--------------------------- 1.3866 second ---------------------------►

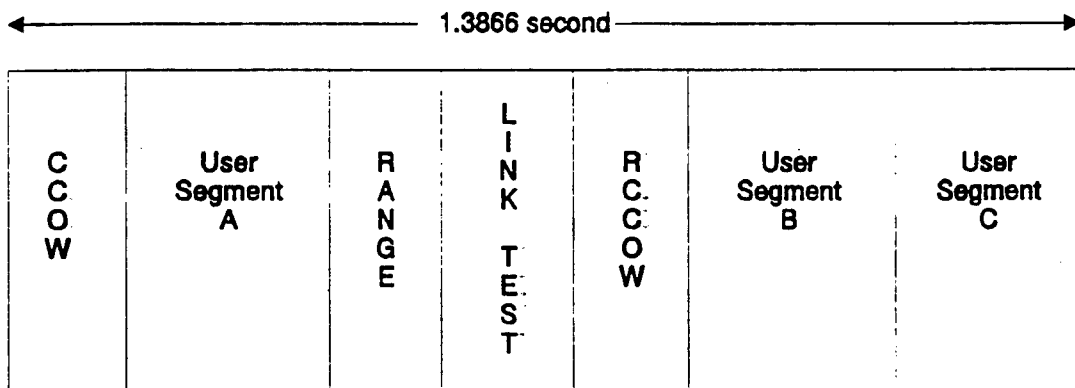| C C O W	User Segment A	R A N G E	L I N K T E S T	R C C O W	User Segment B	User Segment C

Figure 2-7. 25-kHz Frame Format

into 2 subsegments to eliminate contention for those half-duplex terminals (at rf) that require voice communications on two 2400-bps time slots. Appendix C provides additional detail on the TDMA frame structure. Frame Format 2 segments are defined as follows:

A.   **Channel Control Orderwire (CCOW)**. The CCOW is broadcast at the start of each frame. The CCOW is used by the central controller to transmit commands to user earth terminals, respond to service requests, and provide the information essential for earth terminals to attain synchronization.

B.   **User Segments A, B, and C**. These segments of the frame are used for user-to-user traffic. These segments have 16 different fixed formats in which they can operate. The format of the frame is defined in the CCOW master frame, which occurs every eighth frame. Time slots within these segments are assigned by the central controller, based on service requests via the orderwire. Segment A can support data rates between 75 and 1200 bps, B can support data rates between 75 bps and 16 kbps, and C can support data rates between 75 and 2400 bps. Each data rate for the segments is transmitted at designated coding and burst rates.

        The important fact to remember about the 25-kHz frame is that all formats are predefined and stored in the terminals. Time slots are defined as to ID number and start/stop timing. Therefore, when the controller tells a terminal to talk on a specific time slot, that slot always occurs at the same time relative to frame start time. The terminal, therefore, need not interpret the orderwire to be able to communicate on the time slot, once the time slot is assigned.

C.   **Range**. This segment of the frame provides time slots used by user earth terminals to perform ranging operations. Ranging can be accomplished using transmission of ranging signals in shared time slots, or the terminal may be assigned a dedicated time slot. Where active ranging is required, the terminal employs the shared time slots for initial entry into the DAMA network.

D.   **Link Test**. This frame segment provides time slots for performing bit error ratio (BER) tests to determine current operating conditions. A data stream is transmitted to the satellite and the return signal used for this test. Time slots in this segment can be shared or can be dedicated to a specific terminal by the central controller.

E.   **Return Channel Control Orderwire (RCCOW)**. This frame segment is used by the user earth terminals to transmit service requests to the central controller and respond to commands generated by the central controller.

2-7   5- AND 25-KHZ WAVEFORM COMPARISON

        The two DAMA waveforms both have frames, orderwires, and communications segments, but they are extremely different in their implementation. These differences are the root causes for poor voice communications capability of the 5-kHz waveform.

A.   **Frame Length.** The frame length is the cause of delays experienced in a TDMA system. The 5-kHz waveform has approximately a 9-second frame length, and the 25-kHz waveform has a 1.4-second frame length. Since requests for service must be made over the orderwires, each communication between controller and terminal takes a minimum of 9 seconds for the 5-kHz waveform. With a call request, two messages are required between controller and user terminal, meaning, at best case, a call request takes 18 seconds to set up. The push-to-talk delay is also long (9 seconds), and interactive voice is very cumbersome, since the elapsed time from a question being asked to the beginning of the receipt of the answer from the other party would be 18 seconds (twice the waveform delay). In comparison, the 25-kHz waveform can set up a call request in a little over 3 seconds, with an interactive voice delay of 2.8 seconds.

B.   **Frame Structure.** The 5-kHz waveform frame structure is continuously flexible, and the 25-kHz structure is fixed. The 5-kHz was designed to dynamically adapt to changes in data communications traffic demands on a frame-by-frame basis. This is accomplished by variable-size orderwire segments that set up the communications frame structure in the prior frame, based on specific-service requests. This requires that a user terminal must <u>always</u> receive the orderwire to know when to burst in the following frame. For every frame during a communication, the terminal will likely burst in a different time period, based on direction given in the previous FOW.

The 25-kHz, on the other hand, has several fixed formats in which it operates that are set for fairly stable periods of time. A user terminal gets a time-slot assignment once and always talks in that slot until the call is terminated or preempted, whichever comes first. The terminal listens to the orderwire, but if for some reason (noise, errors) does not receive it, can still continue communicating on the time slot that was assigned.

With the 5-kHz, if a FOW is missed, a terminal cannot talk for an entire frame (9 seconds). In addition, since a 5-kHz user must receive the FOW to communicate on that channel, the ability cannot be provided for a 5-kHz user to switch to another 5-kHz channel to talk during the communications part of the frame, and then return to its original channel within 1 frame period.

C.   **Orderwires.** The orderwires on the 5-kHz waveform are variable in content and length; those of the 25-kHz are fixed and short. The 5-kHz offers a greater number of service features, especially for data transmission, because of the complex and elaborate orderwire structure and scheme; however, a great deal of overhead is introduced, which forces the frame to become longer to provide better efficiency. The orderwires offer message and circuit service and multi-hop transmission for circuit mode.

The 25-kHz offers basic circuit service with fixed formats stored in the terminal memory, so that it can be told the time slot to talk on and talk without being concerned with what all the other terminals on the channel are doing. The format also fixes the location of the orderwire slots, so the terminal always knows when to listen and when to send requests for service, even if the previous orderwire was missed.

The terminal operating on a 5-kHz DAMA channel must compute the next frame structure based on data included in the previous FOW. This must be done to determine what time slot is available for transmitting a service request or, for that matter to transmit user data.

3 USER OPERATIONAL ISSUES

This chapter discusses the operational problems that users have identified with the current design of the 5-kHz waveform. These concerns are determined in references A and F through L, and are included in Appendix D.

3-1 COMMUNICATIONS DELAYS

This section reviews the problems that were identified in Reference A with regard to expected communications and set-up delays for the various DAMA modes in providing voice services. Below are the definitions of the identified delays:

● Waveform Acquisition Delays: The time it takes to synchronize with the TDMA waveform.

● Link Set-up Delays: The time it takes to establish a communications path with called user or net.

● Waveform Delays: The time delay associated with buffering the voice signals that is required to operate in the TDMA waveform.

Table 3-1 summarizes the delays that will be experienced for the voice services defined in MIL-STDs 188-181/182/183. The first two columns depict the voice service options available for both the 5- and 25-kHz channels and reflect use of optional orderwires to set up the circuit. The voice service options are for 2.4- or 16-kbps voice, as noted. Note that the link set-up delays are based on which orderwire is being employed and results in a 6-fold decrease with use of the 25-kHz orderwire. The waveform delays on the other hand are determined by the waveform being used for actual communications. The delays shown are the extra time required above the time experienced when operating in the single-net-per-channel dedicated mode, as is currently done. The transmission delay (earth terminal to satellite to earth terminal) and terminal installation times are not included in Table 3-1. All delays have been rounded off to the nearest tenth of a second.

Table 3-1.   UHF DAMA Delays

CHANNEL (kHz)	ORDERWIRE USED (kHz)	MODE	DATA RATE (kbps)	WAVEFORM ACQUISITION DELAY NO COLLISIONS (SECONDS)	LINK SETUP DELAY NO COLLISIONS (SECONDS)	WAVEFORM DELAY (SECONDS)
25	25	TDMA/DAMA	2.4	1.5 to 12.7	3.2 to 4.6	1.4
25	25	TDMA/DAMA	16	1.5 to 12.7	3.2 to 4.6	1.4
25	25	DASA	16	1.5 to 12.7	3.2 to 4.6	0
25	5	DASA	16	27 to 36	18 to 27	0
25	Not Required	Dedicated	16	0	0	0
5	25	DASA	2.4	1.5 to 12.7	3.2 to 4.6	0
5	5	TDMA/DAMA	2.4	27 to 36	18 to 27	9
5	5	DASA	2.4	27 to 36	18 to 27	0
5	Not Required	Dedicated	2.4	0	0	0

The table clearly indicates that the 5-kHz TDMA/DAMA mode is not usable for voice communications due to the long turnaround (waveform) delay.   An interactive conversation would result in time gaps of 18 seconds from end of transmission of User A to receipt of response from User B by User A.   The other problem is that when a voice slot is assigned, it uses nearly all of the bandwidth on the channel, leaving little room for other traffic. Even though voice delays are not a problem with a 5-kHz DASA channel, the set up time of a DASA channel from the 5-kHz orderwire is a concern for many high-priority and special operations users.

In addition to the set up and communications delays, a user concern with the lack of preemption capability of the DASA mode has also been raised.   Once a user has left the DAMA system for DASA operation, he cannot be preempted, since he no longer is receiving DAMA orderwires.   This situation could potentially result in higher-priority traffic not being serviced, while a DASA channel has been assigned to lower-priority traffic for a specified time interval.

3-2 5- AND 25-KHZ TDMA/DAMA CHANNEL SWITCHING

The second area of user-identified operational issues is the inability to switch between and among 5- and 25-kHz TDMA/DAMA time slots.   To provide the greatest efficiency of use of channels and time slots of the UHF SATCOM system, it would be operationally beneficial to be able to send a terminal to a time slot that is not on the channel where it is monitoring its orderwire.   There are two aspects of this operational problem. One is timing and synchronization, and the other is the orderwire and waveform structure differences between the two waveforms.

A. **Timing and Synchronization.** The 5-kHz frame is 8.96 seconds long, and the 25-kHz frame is 1.3866 seconds long. Since the designers never envisioned the two waveforms to work in concert with one another, no provisions were made to enable the two waveforms to synchronize. The waveform durations are not multiples of one another, so there is no short repeat pattern where the two frames have matching start-of-frame times. No control messages exist for sending timing differences between the two waveforms to a terminal switching between the two. The controller has no function defined to keep track of timing differences in real time and to send that information to a terminal. Therefore, whenever a terminal is instructed to switch between 5- and 25-kHz waveforms in the TDMA mode, it must reacquire timing and synchronization of that waveform before communications can take place. Such reacquisition can take typically 15 seconds for a switch to the 25-kHz waveform and 45-63 seconds for a switch to the 5-kHz waveform.

B. **Orderwire and Waveform Structure.** The different philosophy of waveform structure employed on the 5- and 25-kHz waveforms prevents switching between 5- and 25-kHz modes in the TDMA mode without delays. The 5-kHz has a variable internal frame format; the 25-kHz has fixed internal frame formats. The 5-kHz variable frame format was introduced to enable maximum efficiency, but has unfortunately introduced considerable complexity.

To operate on a 5-kHz channel in the TDMA/DAMA mode, the terminal must listen and correctly interpret the FOW before it knows where it can make requests in the next frame, to enable it to talk in some subsequent frame that could be five frames later. The ROW has a variable number of time slots and structure as does the communications segment. There are no provisions to provide a start-of-time slot time in the 5-kHz waveform. There is likewise no message to tell a terminal to switch to a channel and talk on a specific time slot, because time slots are defined in the previous frame's FOW by virtue of circuit assignment messages. Therefore, a terminal cannot change channels from one 5-kHz channel to another 5-kHz channel to talk without waiting, synching, and requesting a time slot on that channel.

The same would be true if a terminal were switching from a 25-kHz channel to a 5-kHz channel in the TDMA/DAMA mode. A message may be possible for development in the 5-kHz waveform to tell a terminal on a 5-kHz channel to switch to a specific 25-kHz channel, provide start-of-frame timing, provide frame format, and provide the time slot.

The 25-kHz TDMA/DAMA mode, on the other hand, operates in fixed formats where the frames, communications segments, and time slots are all predefined. A terminal can be assigned a time slot on another 25-kHz channel to talk, and, during each frame, the terminal switches to either transmit or receive in the assigned

time slot. Then it switches back to listen to the CCOW for any new directions. Switching can occur because once a terminal knows the timing on start-of-frame and the fixed format of the frame (stored in the terminal memory), it can burst in its assigned time slot and communicate. This switching cannot be done with the 5-kHz waveform, because a terminal cannot switch t another channel to talk in the middle of a frame, and return to the original channel to monitor its orderwire. If it goes to another channel, it would not know where to burst without listening to the orderwire for one frame to determine the structure of the next frame. Therefore, the constantly changing internal durations and lack of predefined time slots of the 5-kH waveform make switching channels (switch-talk-switch back) withi a frame duration impossible and switching temporarily a time-consuming exercise.

3-3 COMSEC PERIODS

Several users anticipate operational problems associated with different COMSEC periods for the waveforms. Although this issue would severely limit users from seamless channel switching to maximize use of pooled channel capacity, the waveform structure has no bearing on this issue. This is strictly an operational decision to be made UHF SATCOM system managers and operators that does not require changes to the waveform definition. Along these lines, this issue is being addressed in the *DAMA Joint Key Management Concept* document now in development.

This document calls for all 5- and 25-kHz channels in a satellite footprint to use the same COMSEC key and crypto period With this approach COMSEC would not be a detriment to directing user to a different channel.

3-4 REQUIREMENTS

The Joint Staff has identified the maximum delays that voic communications should experience when operating within the improved 5-kHz waveform. The Joint Staff messages included in Appendix E form the basis of this requirement. Below are the three requirements:

- Frame duration. Less than 2.25 seconds

- Link setup. Less than 8 seconds

- Push-to-talk. Less than 2 seconds

The Joint Staff's stated requirements are supported by CINC and Service concerns with delays experienced in the existing 5-kHz waveform (see CINC and Service messages in Appendix D). The stated concerns can be grouped into three areas:

● Delays significantly impede sensitive communications, which are essential for military operations.

● Delays severely degrade a commander's ability to execute an assigned mission, by limiting the ability to rapidly disseminate critical command and control information.

● Delays are unacceptable for specific operations.

These concerns take into consideration that dedicated and DASA channels could be allocated to the most critical users, as these modes of operation offer the least delay. This operational allocation decision is considered an interim solution, but an exception rather than the rule for a long-term solution. Such allocations reduce the availability of UHF SATCOM resources to a large segment of users, resulting in a loss of throughput capabilities over limited UHF SATCOM resources.

4   ALTERNATIVE OPTIONS EVALUATION

The purpose of this chapter is twofold: to present descriptions of alternative options that address the operational issues, and to provide an assessment of each option.

4-1   ALTERNATIVE OPTION DESCRIPTIONS

This section presents a description of the alternatives considered for improving the 5-kHz UHF DAMA waveform. All of the options were developed using the following assumptions:

- The 25-kHz UHF DAMA waveform structure will remain as currently defined.

- All options assume use of the advanced UHF SATCOM modulation (AUSM) technique that will significantly increase the maximum data rate over 5-kHz channels.

- The operational timing of all 5- and 25-kHz channels will be synchronized within a footprint by the central control facilities.

A.   Option 1 - Develop Short Frame for Voice (1/4 of Original). This option introduces a second 5-kHz waveform for use in the voice mode only. The original waveform will be used for data users. To accommodate voice users, a new waveform with a short frame length equal to one quarter of the current 5-kHz waveform (2.24 seconds) will be defined. This new waveform will use the same timing as the original waveform and operate in parallel with the original waveform. The new short waveform will operate with a newly defined, abbreviated FOW and ROW format. A limited subset of the current messages will be selected and revised, as necessary, to streamline the orderwire procedures. A fixed-frame definition similar to the 25-kHz waveform will also be implemented to simplify waveform access and provide more robust communications capabilities in high-error environments. Figure 4-1 presents an overview of the frame lengths for this option.
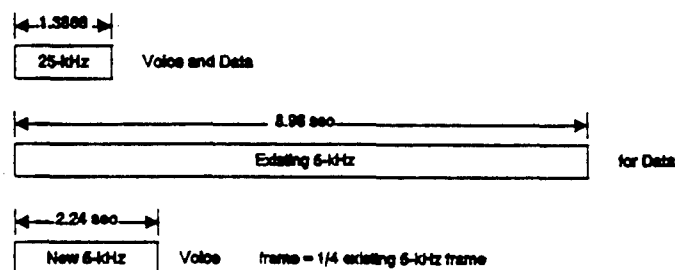

Figure 4-1. Option 1 Frame Lengths

B.   **Option 2 - Develop Short Frame for Voice (Equal or Twice 25 kHz)**. This option is similar to the first option, sinc it defines a new voice-only waveform for 5-kHz operation. The new waveform consists of a short frame that is either equal to c twice the frame length as the 25-kHz waveform, depending on the achievable information rate attainable, employing AUSM techniques. The timing for the new 5-kHz waveform will be operated in synchronization with 25-kHz waveform. The original 5-kHz waveform and protocols are retained for users in the data mode. The new short waveform will operate with a newly defined, abbreviated FOW and ROW format. A limited subset of the current messages will be selected and revised, as necessary, to streamline the orderwire procedures. A fixed-frame definition similar to the 25-kHz waveform will also be implemented to simplify waveform access and freewheeling capabilities in high-error environments. Figure 4-2 presents an overview of the frame lengths for Option 2.
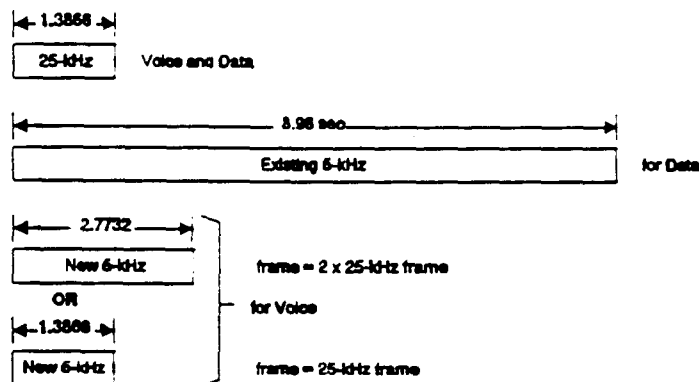
Figure 4-2. Option 2 Frame Lengths

C.   **Option 3 - Make 5-kHz Frame a Multiple of 25-kHz Frame** This option proposes changing the existing 5-kHz waveform frame length to a multiple of the 25-kHz frame and operating a short frame waveform for voice and a long frame waveform for data. Th 5- and 25-kHz waveforms will operate in synchronization. The voice-only short frame waveform will be the same frame length as the 25-kHz waveform and have an abbreviated fixed-format orderwire and frame. A long frame waveform for data users that is 6 times the 25-kHz frame will be provided using the original orderwire and frame scheme. Figure 4-3 presents an overview of the frame lengths for Option 3.

Figure 4-3. Option 3 Frame Lengths

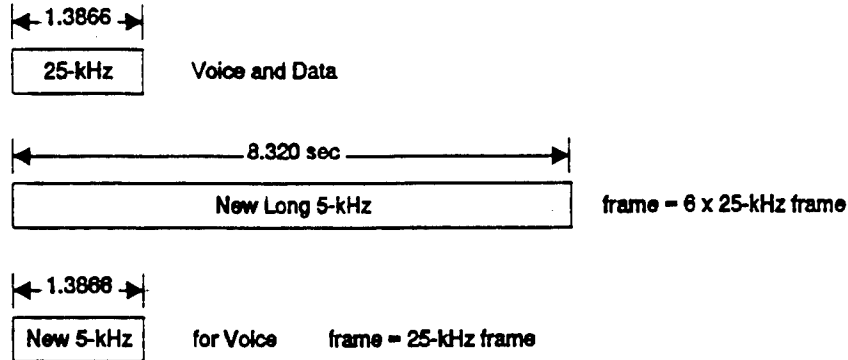D. **Alternative Options Summary.** Table 4-1 is a summary of
the alternative options, highlighting the differences among the
options with respect to frame length, timing, and type of
orderwire formats and procedures proposed.

Table 4-1. Alternative Options Summary

OPTION	FRAME		TIMING		ORDERWIRE	
	DATA	VOICE	DATA	VOICE	DATA	VOICE
1	original 5-kHz	1/4 original 5-kHz	original 5-kHz	original 5-kHz	original 5-kHz	new with fixed format
2	original 5-kHz	1 x 25-kHz 2 x 25-kHz	original 5-kHz	25 kHz	original 5-kHz	new with fixed format
3	6 x 25-kHz	1 x 25-kHz	25 kHz	25 kHz	original 5-kHz	new with fixed format

4-2 **ALTERNATIVE OPTIONS ASSESSMENT**

This section presents an assessment of the alternatives by
presenting the advantages and disadvantages of each. The
advantages and disadvantages are keyed to how well each
alternative addresses the user operational issues presented in
chapter 3.

A. **Option 1 - Develop Short Frame for Voice (1/4 of
Original).** This alternative option alleviates the long
communications set-up and waveform delays of the original 5-kHz
waveform; however, it does little to enhance the switching
between 5- and 25-kHz waveforms, because the timing is not
relative for each waveform. The new orderwire scheme and a
fixed-format frame similar to the 25-kHz orderwire offer less
overhead in the frame, allowing for more traffic-handling
capacity and a more stable transmission system in a higher error
environment. The drawbacks are that a new orderwire scheme must

be defined and the impact on the terminals and the controller will be much greater. The detailed advantages and disadvantages for Option 1 are presented in Table 4-2.

Table 4-2. Advantages and Disadvantages of Option 1

ADVANTAGES	DISADVANTAGES
Reduces voice call set-up delays from 18-27 seconds to 4.5-6.6 seconds	Switching between 5- and 25-kHz modes requires resynchronization acquisition
Reduces waveform delay from 9 to 2.2 seconds	Waveform standard must be revised to define building block counts and new control messages (5- and 25-kHz) to identify new short frame mode, which will affect terminal and controller software
Permits users to switch quickly (1 frame length) between the long and short waveform modes	Additional controller function required to issue/receive orderwires at 2.24-second intervals
With reduced FOW/ROW requirements, more voice paths may be able to be provided per 5-kHz channel	Channels must be assigned/allocated for this mode, adding to a balancing issue of how many are DAMA long, DAMA short, and DASA
New fixed-frame definition will improve continuous communications in high-error environments	Newly defined FOW/ROW formats and protocols must be developed for this mode, which will have a software impact on terminals and on controller development

B.   **Option 2 - Develop Short Frame for Voice (Equal or Twice 25-kHz).** This option alleviates the communications set-up and waveform delays of the original 5-kHz waveform, as well as provides a more seamless operation between the 25-kHz and the new short frame mode, because the timing can be matched to the 25-kHz waveform. The drawback of this alternative is TDMA frame reacquisition when switching between the long and short 5-kHz TDMA frames, because of different timing. The new orderwire scheme and a fixed-format frame similar to the 25-kHz orderwire offer less overhead in the frame, allowing for more traffic-handling capacity and a more stable transmission system in a higher error environment. In addition, a greater opportunity exists with this option to reduce the new short frame to equal the 25-kHz frame, offering even better timing synchronization and much better seamless operation between the 25-kHz and 5-kHz short waveforms. The drawbacks are that a new orderwire scheme must be defined and the impact on the terminals and the controller will be much greater. The detailed advantages and disadvantages for Option 2 are presented in Table 4-3.

Table 4-3. Advantages and Disadvantages of Option 2

ADVANTAGES	DISADVANTAGES
Reduces voice call set-up delays from 18-27 seconds to 5.6-8.4 seconds	Switching between 5-kHz voice and data modes requires resynchronization acquisition
Reduces waveform delay from 9 to 2.8 seconds	Waveform standard must be revised to define building block counts and new control messages (5- and 25-kHz) to identify new short frame mode, which will affect terminal and controller software
Permits users to switch quickly between the 25-kHz mode and the 5-kHz voice mode (1 frame length)	Additional controller function required terminal to issue/receive orderwires at 2.8-second intervals
With reduced FOW/ROW requirements, more voice paths may be able to be provided per 5-kHz channel	Channels must be assigned/allocated for this mode, adding to a balancing issue of how many are 5-kHz DAMA data, DAMA voice, and DASA
	Newly defined FOW/ROW formats and protocols must be developed for this mode, which will have a software impact on terminals and on controller development.

C.   Option 3 - Make 5-kHz Frame a Multiple of 25-kHz Frame.
This option reduces the voice communications and waveform delays
of the original 5-kHz waveform to equal the 25-kHz waveform. The
main performance characteristic of this alternative is that its
timing can be synchronized with the
25-kHz waveform to allow seamless operation (channel switching)
within 1 frame without the need for resynchronization for both
data and voice frame formats. The more simplified orderwire
scheme and fixed-frame format allows greater traffic-handling
capacity, and greater tolerance to interruptions in a higher-
error environment. This option offers the most seamless
operation for providing voice services, channel switching, and
minimizing communications and waveform delays. The main drawback
is that the waveform standard must be revised significantly, and
this will have the greatest impact on the terminal and controller
software. However, revision of the protocols and orderwire
formats for the new, short, 5-kHz frame can be patterned after
the 25-kHz for standards purposes. The detailed advantages and
disadvantages for Option 3 are presented in Table 4-4.

Table 4-4. Advantages and Disadvantages of Option 3

ADVANTAGES	DISADVANTAGES
Reduces voice call set-up delays from 18-27 seconds to 3.2-4.6 seconds for the voice waveform	Waveform standard must be revised to define building block counts for both new waveforms and new control messages (5- and 25-kHz) to identify new short frame mode, which will affect terminal and controller software
Reduces voice waveform delay from 9 to 1.4 seconds	Additional 5-kHz controller function required to issue/receive orderwires at 1.4-second intervals
Provides seamless operation by permitting users to switch between the 25-kHz mode and the 5-kHz modes (1 frame length) without acquisition and re-synchronization	Newly defined FOW/ROW formats and protocols must be developed for the short fixed frame, which will have a software impact on terminals and on controller development.
Provides a fixed-frame format for the short frame to improve performance in high-error environments	Channels must be assigned/allocated for this mode, adding to a balancing issue of how many are 5-kHz DAMA data, DAMA voice, and DASA
Provides abbreviated orderwire format in the short frame to decrease overhead and improve traffic-handling capacity for the short frame mode.	

5 NEXT STEPS

The purpose of this chapter is to provide a proposed process for finalizing the selection and implementation of improvements to the 5-kHz waveform that meet requirements and solve the operational issues identified. The plan is to divide the task of waveform improvement selection into 4 steps:

- Select the frame length and format of the improved waveform. This will be based on the options identified in this report and other options that may be identified by the services or other sources.

- Select the modulation and forward error correction (FEC) coding to be used for the improved waveform. Optional modulation and FEC formats and rates will be those defined in MIL-STD-188-182 and -183 and those selected under the AUSM project.

- Select the services to be offered and the frame time slot configuration required to support these services. This will be done based on the technical and operational capabilities of the user terminals.

- Select the orderwire messages to be used. Options are the messages used by the 5-kHz DAMA, the 25-kHz DAMA, a combination of these two message sets, or a new set of messages.

For each selection and decision opportunity, the current plan that JIEO is pursuing consists of the following steps:

- Identify options for improving the 5-kHz TDMA/DAMA waveform, assess options, and prepare a report documenting results (example, this report).

- Brief the results of the options assessment to users, if it impacts operations, to reconfirm that the identified requirements are met.

- Submit options to the Service Project Managers (PM) for program impact assessment.

- JIEO and Service team select the best option.

- Verify implementation of selected changes.

- Modify and approve UHF SATCOM standards and radios.

The plan ensures involvement with all interested parties. The engineers, PMs, users, and standards developers will work together to ensure that a system is produced to satisfy user needs with the least impact to ongoing programs. The plan also

includes the provision for the PMs to submit their 5-kHz
TDMA/DAMA frame and format solutions as part of their impact
assessments performed in the third step. In addition, after a
selected solution is made in the fifth step, PMs can begin
implementing TDMA frame and format changes to their programs.

APPENDIX A

GLOSSARY OF ACRONYMS

AUSM	advanced UHF SATCOM modulation
BER	bit error ratio
bps	bit per second
C3I	command, control, communications, and intelligence
CCOW	channel control orderwire
COM	communications
COMSEC	communications security
DAMA	demand-assigned multiple access
DASA	demand-assigned single assess
FOW	forward orderwire
JCS	Joint Chiefs of Staff
JIEO	Joint Interoperability and Engineering Organization
kbps	kilobit per second
kHz	kilohertz
MCEB	Military Communications-Electronics Board
MILSATCOM	military satellite communications
OW	orderwire
PM	project manager
RCCOW	return channel control orderwire
rf	radio frequency
ROW	return orderwire
SATCOM	satellite communications
TDMA	time-division multiple access
UHF	ultra high frequency

APPENDIX B

5-kHz TDMA FRAME STRUCTURE

B-1 INTRODUCTION

This appendix provides additional detail on the structure of the 5-kHz waveform so readers may better understand how waveform design affects the capability to switch from one DAMA channel to another. The appendix is not intended to describe all design characteristics. For the reader who needs this detail, see MIL-STD-188-182.

B-2 GENERAL

Figure B-1 depicts the structure of the TDMA frame, which is divided into 1,024 increments known as *building blocks*. Each building block is 8.75 ms long. The number of building blocks defines the start and stop time for each communications. Each terminal can calculate these start and stop times based on information contained in the FOW and a priori knowledge of frame structure. The building blocks are grouped into segments, the segments into time slots, and the time slots into fields. Below, in B-3 and B-4, each of the segments is discussed.
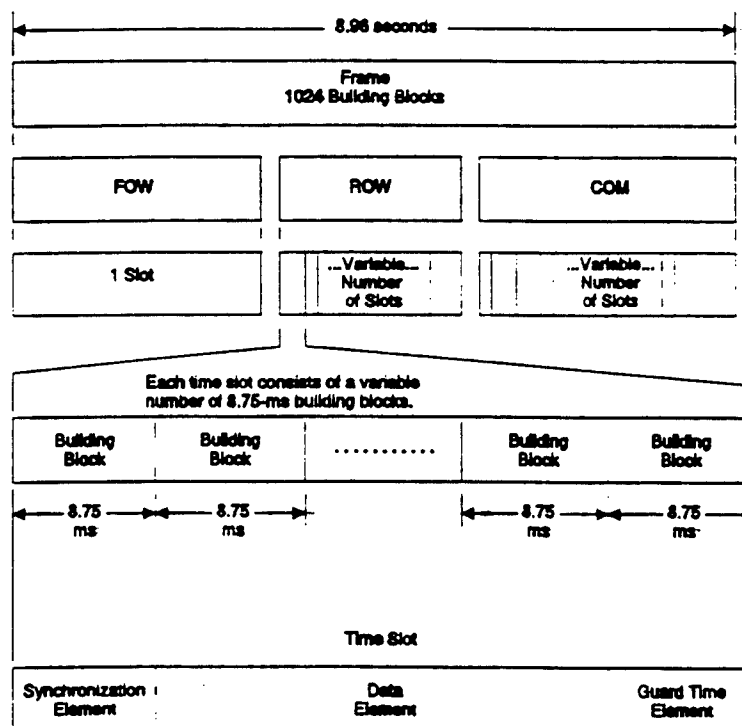

Figure B-1. 5-kHz Frame Format

B-3 FOW

The FOW consists of 420 bits of data plus a variable number of directed messages. There are 31 defined FOWs that vary in length from 22 to 91 bits. The variable length of each message and the variation in the number of directed messages that can be included in each FOW make the length of the FOW, in building blocks, variable. This variability is driven by the level of traffic loading and need for control actions to maintain efficient DAMA network operation.

B-4 ROW

The ROW consists of a variable number of ranging and messag time slots. The first time slots, within the frame, are allocated to ranging and are accessed on a contention basis. Th contention ranging time slots are followed by assigned message and ranging time slots, which may be intermingled. The assigned ranging and message time slots are followed by contention messag time slots.

    A. Contention Ranging Time Slots. Each contention rangin time slot contains 348 data bits or 32 building blocks. The number of contention ranging time slots available in each ROW segment is announced in each FOW.

    B. Assigned Ranging Time Slots. Each of these time slots is 348 bits or 32 building blocks. Assignment of ranging time slots in each frame is determined by the central controller, based on giving terminal a dedicated time slot to perform rangin at least every 4.5 hours and in response to a request from a terminal for an assigned ranging time slot. The terminal determines the start time for an assigned time slot based on the order in which the assignment was made in the FOW. The terminal receiving the first assignment would use the first available tim slot following the last contention ranging time slot. The terminal receiving the second assignment would transmit in the second available time slot, and so forth.

    C. Assigned Message Time Slots. The assigned message time slots contain 502 data bits or 17 building blocks. The number o: assigned ROW messages in each frame depends on the number of requests received from user terminals that require assigned time slots and the need for control actions on the part of the controller. Each earth terminal is advised of the assignment of a time slot via the directed message field in the FOW. This notification occurs one frame in advance of ROW transmission. The determination of the start point for assigned ROW messages, within the assigned message portion of the frame, is based on the ordering of the assignments in the FOW, as discussed in B-4B. Section 6 of MIL-STD-188-182 discusses how each terminal determines the ROW message start time in building blocks.

D. **Contention Message Time Slots.** The contention message time slots contain 502 data bits or 17 building blocks. The contention message time slots follow the last assigned ranging and message time slot. All the time from immediately following the end of the assigned ROW time slots (determined by parsing the FOW) and preceding the assigned communications time slots (also determined by parsing the directed messages portion of the FOW) is available for contention ROW messages. The number of time slots can be determined by dividing the time available by 17 (the number of building blocks for each message).

B-5 COMMUNICATIONS

Communications time slots are all assigned by the central controller, based on user service requests. The time slots, which follow the last ROW contention message, vary in length and number, based on the communications service being provided. Time-slot size is based on user service request and central controller determination of the modulation rate and coding requirements, taking into consideration the end-to-end link quality. The number of time slots assigned is based on the size of individual service requests. The determination of the starting location, in building blocks, for each time slot is based on the ordering of the assignments in the FOW. Time slots are assigned from the latest to the earliest. Thus, the terminal receiving the first assignment transmits in the last time slot in the communications segment. The second transmits immediately following the first, and so forth. The earth terminal must receive the FOW to determine this location. Section 6 of MIL-STD-188-182 shows how to determine time-slot location, in building blocks.

B-6 TIME-SLOT LOCATION

The flexibility of the 5-kHz TDMA frame dictates that the user terminals determine specific time-slot locations, based on information contained in the FOW, on knowledge of the length of the various time slots, and on established rules.

A. **FOW-Provided Data.** Each FOW provides the following information needed to locate time slots:

1. Frame start and stop time.

2. Length of Next FOW in building blocks.

3. Number of contention ranging time slots.

B. **Length of Time Slots.** The length of each of the following time slots is available to each terminal:

1. ROW ranging time slots, both contention and assigned, are 32 building blocks long.

    2.   ROW message time slots, both contention and
          assigned, are 17 building blocks long.

    C.   **Time-Slot Location Rules.** Assistance in locating
assigned ranging and message time slots is provided by the
following rules:

          1.   <u>Assigned Ranging</u>. The order in which the
assignments are made in the FOW determine which time slot to u.
The terminal receiving the first assignment would transmit in
first available time slot immediately following the last
contention ranging time slot. The terminal receiving the seco:
would transmit in the next, and so forth.

          2.   <u>Assigned ROW Communications</u>. The order in whic:
the assignments are made in the FOW determines which time slot
use. Time slots are assigned from latest to the earliest. Th:
terminal receiving the first assignment would transmit in the
last time slot. The second transmits in the next available, a:
so forth.

APPENDIX C

25-kHz TDMA FRAME STRUCTURE

C-1 INTRODUCTION

This appendix provides additional detail on the structure of the 25-kHz waveform so readers may better understand how waveform design affects the capability to switch from one DAMA channel to another. The appendix is not intended to describe all design characteristics. For the reader who needs this detail, see MIL-STD-188-183.

C-2 GENERAL

Unlike the 5-kHz TDMA frame, the 25-kHz frame is fixed. The only variation available is the 2 separate formats and the different subformats for user communications. Figure C-1 depicts the TDMA frame, which is divided into 7 separate segments. Note in Figure C-1 that each of these segments has a fixed length. Each frame is subdivided into 26,624 time chips, each chip having the duration of 52.083 microseconds (μs). To find the length of each segment in time chips, divide the time in milliseconds (ms), as noted in Figure C-1, by 52.083 μs. Each of the segments, as noted in Figure C-1, is defined by start and stop time in time chips. Terminal knowledge of the frame format and subformat discussed below permit location of each time slot. In the discussion below, note that at a 9.6-kbps modulation rate there is 1 bit per 2 time chips.

C-3 CCOW

The CCOW employs 9.6-kbps modulation rate. This segment is fixed in length and has a duration of 960 time chips or 50 ms. The bits employed in the transmission are 248 for preamble and 224 for information, or a total of 472 bits. Allocation for guard time at the end of the segment is 16 time chips or 833 μs.

C-4 RANGE

The range segment employs a 9.6-kbps modulation rate. This segment is also fixed with a duration of 1,455 time chips or 75.781 ms. This includes the transmission of 248 bits for preamble and 80 bits for information for a total of 328 bits or 656 time chips (34.166 ms). The remaining 799 time chips are allocated to guard time. This guard time is allocated at the start and end of the segment.
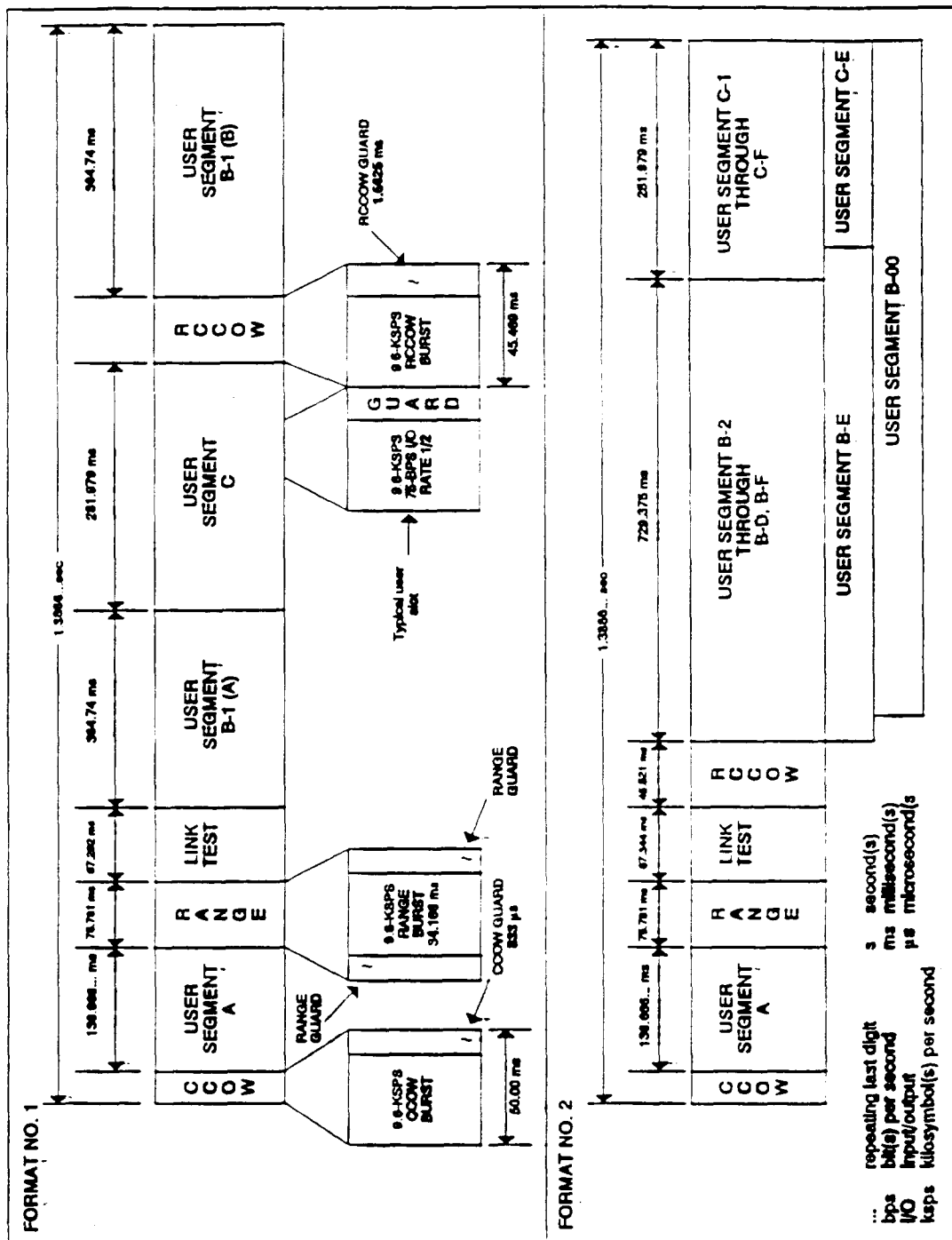
Figure C-1. TDMA Frame Formats

C-5 LINK TEST

The range segment employs a 9.6-kbps modulation rate. This segment is also fixed with a duration of 540 time chips. This consists of 72 information bits, 198 preamble bits, and 637 time chips for guard time. The guard time is broken down to 60 time chips at start of slot and 577 at end of slot.

C-6 USER SEGMENTS

User segments are distributed within the frame as noted in Figure C-1. These segments are further subdivided or broken into separate subformats. Figure C-2 depicts the multiple subformats available in user segment A. The separate subformats are designated by alphanumeric characters, as noted in the left margin opposite each line. This designation, along with the slot number, noted directly above each of the lines, uniquely identifies each time slot. Note that each time slot has associated with it a specific baseband data rate in bps.

Figure C-3 depicts the time-slot definition for user segment A subformats. As noted in Figure C-3, the total segment is 136.666 ms long with 3 equal-length (in time) user time slots (1, 2, and 3). Each of the user time slots consists of preamble (for synchronization), data bits, and guard time to reduce overlapping signals. The preamble for subformat 1 consists of 198 bits, and the data included in each burst is 224 bits for a total of 422 bits. At the 9.6-kbps modulation rate there is 1 bit per 2 time chips. Thus, for each of the user time slots, there are 844 time chips. With the addition of guard time between each time slot and at the end of the user segment (30 at the end of time slot 1 and 31 each at the end of the remaining 2 time slots), the total length of the segment is 2,624 time chips derived as follows:

Segment length = (844 x 3) + 92 = 2,624 time chips

where

time chip duration = 52.083 μs

C-7 MULTIPLE TIME SLOTS AVAILABLE

As noted in the above discussion, there are multiple options available to support user communications. Each of the options is selected by the central controller based on which will best support the predominant traffic being experienced on the channel being controlled.

A. **Two Separate Formats.** As noted in Figure C-1 there are two separate formats available. The only common placement of the frame segments between the two formats is CCOW, User Segment A, Range, and Link Test segments. The user terminals are advised of

A - SEGMENT

Figure C-2. User Segment A Subformats/Time Slots
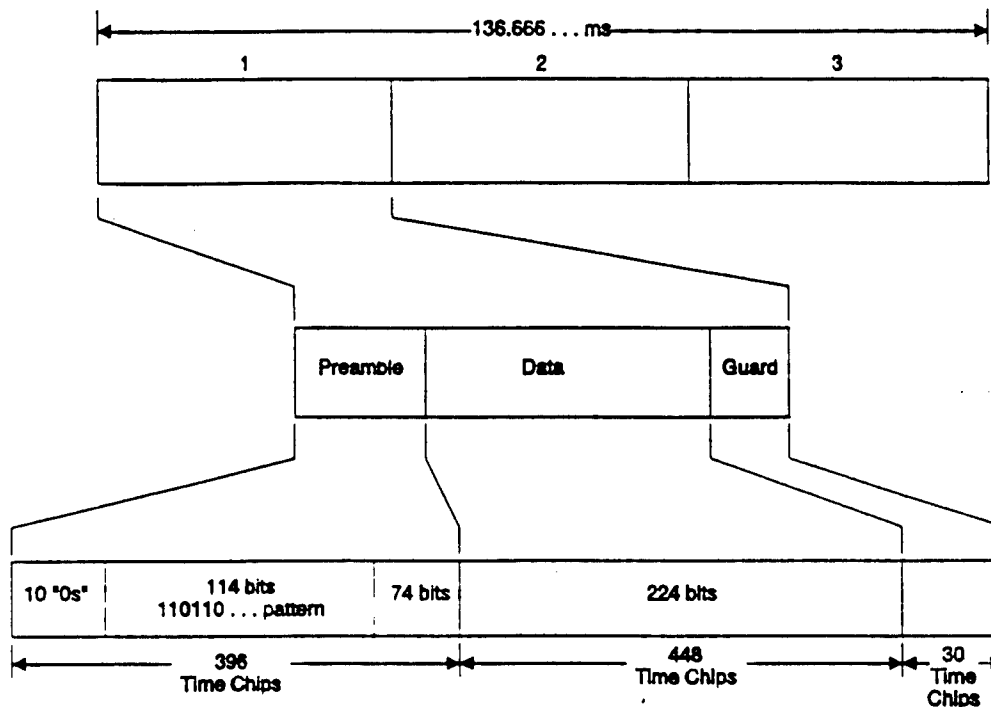
Figure C-3. User Segment Format A - Subformat 1

the format in use via a data field in the master frame. This master frame is transmitted every 8th frame. The central controller can change the frame format to better accommodate traffic requirements. This change can occur only immediately following the transmission of a master frame.

B. Multiple Subformats. There are multiple subformats. Each of the time slots available in each of the subformats is defined by the start and stop time, in time chips, with the reference being the start time for the TDMA frame. The assignment of a specific time slot within any of the user segments is determined by the central controller, based on (1) user I/O data rate and link quality and (2) time-slot size. The central controller selects the specific subformat, based on traffic requirements.

1. <u>User Segment A</u>. This segment has 15 separate subformats. Within 7 of these subformats, there are multiple time slots available.

2. <u>User Segment B</u>. This segment has 2 separate time-slot allocations depending on whether frame format 1 or 2 is being used. When format 1 is used, 2 equal time slots are provided. Frame format 2 provides 16 separate subformats; 12 of these subformats provide multiple time slots.

3. <u>User Segment C</u>. This segment also has 2 separate time-slot allocations, depending on whether frame format 1 or 2 is being used. When frame format 1 is used, there are 15 separate subformats available; 14 of these subformats provide multiple time slots. Frame format 2 also provides 15 separate subformats, with 14 of these subformats providing multiple time slots.

For communications to occur, each earth terminal must know the following:

- Frame format. This information is obtained from the master frame transmitted every 8th frame.

- Time-slot number. This slot number is identifie by subformat number and slot number. Figure C-2 depicts these two numbers.

The earth terminals, which are synchronized with the TDMA frame, can locate the proper time slot by knowledge of its location, in time chips, from the start of the frame.

APPENDIX D

USER COMMUNITY MESSAGES

ROUTINE
R 081840Z JUN 92   ZYUW RHDIAAA6890 160 745
FM HQ ACC LANGLEY AFB VA//DR//
TO RUEAHQA/HQ USAF WASH DC//XOO/XOR/SCM//
RUEAHQA/SAF WASH DC//AQP/AQS//
INFO RUCUAAA/HQ SAC OFFUTT AFB NE//DO/XR/SC//
RUEOFFA/ESD HANSCOM AFB MA//CV/AW/AV//
RUVOARA/OC-ALC TINKER AFB OK//CC/LAK/LAC/LAA//
RUQVCCC/AFCSC KELLY AFB TX//SR//
RUQVAAF/HQ AFIC KELLY AFB TX//XP/DO//
RUVOABA/552ACW TINKER AFB OK//CC/WR//
RHDIAAA/HQ TAC LANGLEY AFB VA//DOY/LGM/SCK/SMO-J//
RUEOFFA/TAC AIR CMD SYS OFC HANCOM AFB MA//TACSO-E//
ACCT AF-ACXJRF

UNCLAS
SUBJ: JCS MANDATED ULTRAHIGH FREQUENCY (UHF) SATELLITE
COMMUNICATIONS (SATCOM) REQUIREMENTS
REFS: A. MJCS 36-89, UHF SATCOM SECURE VOICE POLICY
B. MJCS 63-89, UHF SATCOM DEMAND ASSIGNED MULTIPLE ACCESS (DAMA)
REQUIREMENTS
C. MIL-STD-188-181, INTEROPERABILITY STANDARD FOR DEDICATED 5 KHZ
AND 25 KHZ UHF SATCOM (DRAFT)
D. MIL-STD-188-182, MILITARY STANDARD FOR 25 KHZ UHF TDMA/DAMA
TERMINAL (DRAFT)
E. MIL-STD-188-183, MILITARY STANDARD FOR 5 KHZ UHF DAMA TERMINAL
(DRAFT)
1. REFS A AND B MANDATE REQUIREMENTS FOR SATELLITE ACCESS BEGINNING
IN 94 AND 96. REF A MANDATES CRYPTO AND SIGNAL MODULATION
REQUIREMENTS FOR INTEROPERABILITY. REF B ESTABLISHES A 25 KHZ
REQUIREMENT FOR DAMA AND A 5KHZ DAMA REQUIREMENT FOR THOSE THAT
IMPLEMENT THE OPTIONAL 5 KHZ CHANNELIZATION. REFS C, D, AND E ARE
THE DRAFT MIL STANDARDS PROPOSED TO MEET THE JCS MANDATE.
2. REQUEST AN ACROSS THE BOARD REVIEW OF THE NEED FOR DAMA AND
THE IMPLEMENTATION DATES (FY94-96) OUTLINED IN ABOVE REFS. OUR
UNDERSTANDING IS THAT THE MILITARY STANDARDS ARE STILL IN DEVELOPMENT
AND DEFINITIVE HARDWARE AND SOFTWARE SPECIFICATIONS AND SUPPORTING
COST ESTIMATES ARE NOT AVAILABLE FOR ORDERLY INCLUSION IN THE
REQUIREMENTS PROCESS.
3. OUR PRELIMINARY REVIEW OF DAMA INDICATES REPLACEMENT OR MAJOR
MODIFICATION OF EVERY UHF SATELLITE SYSTEM IN THE CAF IS REQUIRED.
THE TECHNICAL NEEDS OF FAST MOVING AIRBORNE PLATFORMS COMPOUNDED WITH
INHERENT CO-SITE PROBLEMS AND THE NEED TO WORK ON VOICE DO NOT SEEM
TO BE ADEQUATELY ADDRESSED. IN THE CURRENT FISCAL ENVIRONMENT WE
NEED TO REASSESS THE BENEFITS AGAINST THE COSTS OF THIS UPGRADE AND
SET ACHIEVABLE IMPLEMENTATION TIME LINES. REQUEST YOUR SUPPORT IN
LEADING THIS EVALUATION.
4. HQ ACC POINTS OF CONTACT ARE MAJ WILCOX AND CAPT KINCAID,
DRCA.
DSN 574-5527. BT

MESSAGE PREPARATION HINT ON SARAHLITE RELEASING DOCUMENTS,
THE RELEASER'S NAME APPEARS IN THE TEXT AT THE TOP AND
THE RELEASER'S SIGNATURE APPEARS AT THE BOTTOM OF THE PAGE.

DISTRIBUTION   10
ACTION AQ(2) XOO(1)   (U,F)
INFO   XOR(1) SC(1) XOOO(1) XOOOC(1) TE(2) OPR AQ(0)
        FILE CY(1)

ROUTINE   ZYUW RUCJAAA8681 2852011
R 121800Z OCT 93
FM USCINCSOC MACDILL AFB FL//SOJ6/
TO   JOINT STAFF WASHINGTON DC//J6/J6S//
INFO COMNAVSPECWARCOM CORONADO CA//J6//
     HQ AFSOC HURLBURT FLD FL//J6//
     CDRUSASOC FT BRAGG NC//AOIM-TH//
     CDRSIGCEN FT GORDON GA//ATZH-TS//

UNCLAS
MSGID/GENADMIN/USSOCOM SOJ6-0//
SUBJ/DAMA TIME DELAY//
REF/A/CON/WASHINGTON DC J6/10AUG93//
REF/B/MSG/USASOC/211600ZSEP93/-/NOTAL//
NARR/REF A WAS MILSATCOM USERS CONFERENCE (10-13 AUG 93) IN WHICH THE
TOPIC OF DAMA TIME DELAY WAS IDENTIFIED AS A POTENTIAL PROBLEM TO THE
OPERATING FORCES AND WAS SUBSEQUENTLY INCLUDED AS AN ACTION ITEM.
REF B WAS A REITERATION OF THE DAMA DELAY PROBLEM AND EXPRESSION OF
OPERATIONAL CONCERN TO THIS HEADQUARTERS FROM THE COMPONENT LEVEL.//
POC/H.C. COBB/COL/USSOCOM SOJ6-0/LOC:MACDILL AFB FL/TEL:DSN 968-3225
//
RMKS/1. THE PURPOSE OF THIS MESSAGE IS TO RESTATE OUR CONTINUED
CONCERN OVER THE INHERENT TIME DELAYS IN THE DAMA WAVEFORM PREAMBLE
PROTOCOLS. AVERAGE 5KHZ CIRCUIT SETUP DELAYS OF 30 SECONDS ARE
OPERATIONALLY UNACCEPTABLE. DELAYS SIGNIFICANTLY IMPEDE SENSITIVE
COMMUNICATIONS WHICH ARE ESSENTIAL FOR SPECIAL OPERATING FORCES
COMMAND AND CONTROL.
2. OUR REQUIREMENTS DICTATE IMMEDIATE AND POSITIVE COMMUNICATIONS.
THEREFORE, WE REQUEST YOU RESEARCH ENGINEERING AND/OR PROCEDURAL
SOLUTIONS TO DRIVE ANY TIME DELAY TO ZERO FOR SOF OPERATIONS.
3. THIS IS A J6/J3 COORDINATED MESSAGE.// BT

JOINT STAFF VI
ACTION J6 (8)   (U,6,7,8,F)
INFO   NMCC:CWO(1) J3:SOO-J(1) NIOS(1) J7(6)
       QUAL CONTROL(1) J6E-J(1) J5:ASIA-J(1) J6S-J(1)
       J6B-J(1)

OPERATIONS
SUPPORT DIRECTORATE

ROUTINE   ZYUW RHCGGAA0451 2812026
R 041500Z OCT 93
FM CDRSIGCEN FT GORDON GA//ATZH-DC//
TO   CDRTRADOC FT MONROE VA//ATCD//
     DA WASHINGTON DC//DAMO-FD/SAIS-ZA//
     DISA WASHINGTON DC//AS//
     CDRUSACAC FT LEAVENWORTH KS//ATZL-CD//
INFO JOINT STAFF WASHINGTON DC//J61//
     CDRCECOM FT MONMOUTH NJ//AMSEL-CG//
     DCDRUSASDC HUNTSVILLE AL//CSSD-ZB//
     PEO COMM SYS FT MONMOUTH NJ//SFAE-CM//
     CDRSIGCEN FT GORDON GA//ATZH-CDM/ATZH-DC//

UNCLAS
MSGID/GENADMIN/CDRSIGCEN FT GORDON GA/ATZH-CDM//
SUBJ/5KHZ DEMAND ASSIGNED MULTIPLE ACCESS (DAMA) CALL SET UP DELAY//
RMKS/PERSONAL FOR MG LEHOWICZ, MG GARNER, RADM CAMPBELL, MG WHITE, BG
ANDERSON. INFO FOR MG KELLEY, MG GUENTHER, BG VAN PROOYEN, BG GUST;
FROM BG BUCHHOLZ, DCG. SIGCEN//
1. RISING CONCERNS EXIST REGARDING CURRENT UHF 5KHZ DAMA
IMPLEMENTATION. ARMY SPECIAL OPERATIONS COMMUNITY, III, V, XVIII
CORPS, AND FORSCOM HAVE INDICATED STRONG OPPOSITION TO WAVEFORM BASED
ON ITS INABILITY TO MEET OPERATIONAL REQUIREMENTS. AS ARMY USER
REPRESENTATIVE, THESE CONCERNS HAVE BEEN IDENTIFIED AT NUMEROUS
PLANNING AND ENGINEERING MEETINGS. FORMALLY STATED, CURRENT 5KHZ
DAMA SOLUTION (MIL-STD-188-182) DOES NOT MEET REQUIREMENTS FOR ARMY
OPERATIONS. CURRENT ENGINEERING SOLUTION INTRODUCES AN ESTIMATED
AVERAGE CALL SET UP DELAY OF 30 SECONDS OR GREATER. POTENTIAL FOR
ADDITIONAL DELAY OF 17 SECONDS PER TRANSMISSION (WITHOUT CONTENTION)
IS A REALITY. THIS DELAY WILL NOT PROVIDE THE RESPONSIVENESS
REQUIRED BY THE WARFIGHTER.
2. ARMY VOICE USERS REQUIRE NEAR REAL TIME COMMUNICATIONS FOR
CRITICAL COMMAND AND CONTROL FUNCTIONS. ADDITIONALLY, WARFIGHTING
COMMANDERS REQUIRE CAPABILITY TO RAPIDLY DISSEMINATE CRITICAL THREAT
INFORMATION VITAL FOR PROTECTION OF OUR SOLDIERS. DELAYS INHERENT IN
CURRENT UHF DAMA WAVEFORM WILL SEVERLY DEGRADE COMMANDERS ABILITY TO
EXECUTE ASSIGNED MISSIONS.
3. OPERATIONAL IMPACTS WILL EXTEND TO BOTH VOICE AND DATA USERS.
ESTABLISHED VOICE NETWORKS WILL LOSE 5KHZ SATELLITE ACCESS IF ALLOWED
TO REMAIN IDLE AND WILL BE FORCED TO REESTABLISH NETWORK (SUBJECT TO
ANOTHER 30 SECOND DELAY) EACH TIME COMMUNICATIONS ARE REQUIRED.
INCREASE IN DATA USERS HAS DRIVEN DEVELOPMENT OF TACTICAL DATA
NETWORKS. TO SIGNIFICANTLY REDUCE UNIQUE STOVEPIPE AUTOMATED SYSTEMS
LOCAL AND WIDE AREA NETWORKS (LANS AND WANS) ARE IN PLACE. SUCH
NETWORKS WOULD BE HIGHLY SUSCEPTIBLE TO TIME-OUT ERRORS DUE TO DELAYS
INHERENT IN UHF DAMA WAVEFORM. ANY SOLUTION WHICH ADVERSELY AFFECTS
WARTIME OPERATIONS IN SUPPORT OF COMMANDER IS A STEP BACKWARDS.
5. STRONGLY RECOMMEND THE 5 KHZ DAMA WAVEFORM BE REDESIGNED TO
BETTER SUPPORT COMMANDER'S WARFIGHTING REQUIREMENTS. UNDERSTAND DAMA
IMPLEMENTATION BY FY96 IS IMPORTANT TO ALL CONCERNED, BUT MUST HAVE A
SYSTEM WHICH IS OPERATIONALLY ACCEPTABLE. STRONGLY SUSPECT OTHER
SERVICES HAVE SAME CONCERN.
6. VERY RESPECTFULLY//
  BT

CORRECTED DISTRIBUTION

ACTION DAMO/MG GARNER/(1)   (M)
INFO   SAIS/MG WHITE/(1) SCB REVIEW(1)

PAPPAS

** NARRATIVE MESSAGE **

TOR = 022208Z AUG 94
- -
ACTION = [TCC,JSOC]   J6(2)   NCOIC(1)
INFO =
- -
[TCC,JSOC]TOTAL COPIES = 3   MOC = AUTO

RAAUZYUW RUCJAAA2438 2141922-UUUU--RUEOFAA.
ZNR UUUUU
R 011605Z AUG 94
FM USCINCSOC MACDILL AFB FL//SOJ6//
TO RUEKJCS/JOINT STAFF WASHINGTON DC//J51/J6N//
INFO RUEKJCS/SECDEF WASHINGTON DC//OASD-C3I//
RUWMEGA/USCINCSO HOWARD AFB PM//SCJ6//
RUWTNOK/USCINCSPACE PETERSON AFB CO//J40-J6/A43
RUCUSTR/USCINCSTRAT OFFUTT AFB NE//J6//   CHIEF_____
RHCUAAA/USCINCTRANS SCOTT AFB IL//TCJ6//   AF OPS OFF_____
RUEAOWO/DA WASHINGTON DC//DAMO-FOC/SAIS-SOX//   ARMY OPS OFF_____
 UENAAA/CNO WASHINGTON DC//N6/N63//   NAVY OPS OFF_____
 JEAHQA/HQ USAF WASHINGTON DC//SCM/XO//
 JEACMC/CMC WASHINGTON DC//C4I//   ARMY TECH OFF
 UEPNMO/DIR JIEO FT MONMOUTH NJ//TBB/TBBA//   ARMY OPS NCO_____
RUEJOCA/OISA WASHINGTON DC//CFE/UTTM/MSO//
RUCJAAA/USCINCSOC MACDILL AFB FL//SOJ6/J6I/J60// NCO_____
RUSNNOA/USCINCEUR VAIHINGEN GE//ECJ6//
RUWFAFK/COMNAVSPECWARCOM CORONADO CA//N6//   ... NCO_____
RHCOAAA/AFSOC HURLBURT FLD FL//SC//
 UEOFAA/COR JSOC FT BRAGG NC//J6//
 UERHNA/CORUSASOC FT BRAGG NC//AOIM//

PAGE 2 RUCJAAA2438 UNCLAS
RUCJICS/COMSOCCENT MACDILL AFB FL//J6//
RUSNNOT/COMSOCEUR VAIHINGEN GE//J6//
RUAGKFC/COMSOCKOR SEOUL KOR//J6//
RUCOBBA/COMSOCLANT//J6//
RUHQHQO/COMSOCPAC HONOLULU HI//J6//
RHLBAAE/COMSOCSOUTH QUARRY HEIGHTS PM//J6//
RUCBSAA/CINCUSACOM NORFOLK VA//J6//
RUCJACC/USCINCCENT MACDILL AFB FL//CCJ6//
RUHQHUB/USCINCPAC HONOLULU HI//J6//
RHCGGAA/CORSIGCEN FT GORDON GA//CG//
BT
UNCLAS

MSGID/GENADMIN/USSOCOM SOJ6-I//
SUBJ/5KHZ DAMA VOICE FIX//
REF/A/GENADMIN/JOINTSTAFF J61/222300ZJUL94//
REF/B/GENADMIN/USCINCSOC SOJ6/121800ZOCT93/-/NOTAL//
REF/C/GENADMIN/JOINT STAFF J61/121930ZJAN94//
NARR/JOINT STAFF DELINEATES JIEO STRATEGY TO UPGRADE THE 5KHZ DAMA
WAVEFORM IN REF A. IN REF B, USCINCSOC EXPRESSES J3/J6 OPERATIONAL
REQUIREMENT FOR ZERO TIME DELAY FOR SPECIAL OPERATIONS FORCES. REF C

PAGE   3 RUCJAAA2438 UNCLAS
ACKNOWLEDGED ARMY AND USCINCSOC CONCERNS ON DAMA TIME DELAYS.//
RMKS/1. OBJECTIVE FOR PROPOSED JIEO UPGRADE FOR THE 5KHZ DAMA
WAVEFORM (REF A) DOES NOT MEET THE USCINCSOC OPERATIONAL REQUIREMENT
AS STATED IN REF B. ALTHOUGH THE REQUIREMENT FOR ZERO TIME DELAYS
WAS ACKNOWLEDGED (REF C), THE PROPOSED UPGRADED WAVEFORM IS EXPECTED
TO HAVE A 12.25 SECONDS OR LESS DELAY FROM CALL UP TO RECEPTION.
THIS IS STILL AN UNACCEPTABLE DELAY FOR THE OPERATOR IN THE FIELD WHO
MAY BE TRYING TO CALL IN FIRE SUPPORT.
2. BELIEVE MODERN COMPUTING POWER COULD BE BROUGHT TO BEAR IN A
SOLUTION WHICH WOULD DRIVE TIME DELAY FACTOR DOWN TO NEAR ZERO.
TODAY'S TECHNOLOGY AND SMART RADIOS SUPPORT REAL TIME CONNECTIVITY,
AND DAMA PROCEDURES SHOULD BE DESIGNED TO TAKE ADVANTAGE OF THEM.
3. IN THE CASE WHERE OPERATORS LIVES ARE AT STAKE, AN 80 PERCENT
SOLUTION IS NOT ACCEPTABLE. REQUEST CONTINUE TO PURSUE A ZERO DELAY
SOLUTION.//
BT
#2438

NNNN

RAAUZCSW RUCJAAA6089 2661904 MTMS-UUUU--RUEJCCA.2661909 033237 09-23-94
ZNR UUUUU
R 231300Z SEP 94
FM USCINCSOC MACDILL AFB FL//SOJ6//
TO RUEJDCA/DISA WASHINGTON DC//D/D6//
RUEKJCS/JOINT STAFF WASHINGTON DC//J6/J62//
INFO RUEKJCS/SECDEF WASHINGTON DC//OASD-C3I//
RUCJACC/USCINCCENT MACDILL AFB FL//CCJ6//
RUCBSAA/CINCUSACOM NORFOLK VA//J6//
RUHQHQB/USCINCPAC HONOLULU HI//J6//
RUSNNOA/USCINCEUR VAIHINGEN GE//ECJ6//
RUWMEGA/USCINCSO HOWARD AFB PM//SCJ6//
RUWTNOK/USCINCSPACE PETERSON AFB CO//J40-J6//
RUCUSTR/USCINCSTRAT OFFUTT AFB NE//J6//
RHCUAAA/USCINCTRANS SCOTT AFB IL//J6//
RUEADWD/DA WASHINGTON DC//DAMO-FDC/SAIS-SDX//
RUENAAA/CNO WASHINGTON DC//N6/N63//
RUEAHQA/HQ USAF WASHINGTON DC//SCM/XO//
RUEACMC/CMC WASHINGTON DC//C4I//
RUERHNA/CDRUSASOC FT BRAGG NC//AOIM//
RUWFAFK/COMNAVSPECWARCOM CORONADO CA//N6//
RHCDAAA/AFSOC HURLBURT FLD FL//SC//
RUEOFAA/CDR JSOC FT BRAGG NC//J6//
RUSNNOT/COMSOCEUR VAIHINGEN GE//J6//
RUAGKFC/COMSOCKOR SEOUL KOR//J6//
RUHQHQD/COMSOCPAC HONOLULU HI//J6//
RUCJICS/COMSOCCENT MACDILL AFB FL//J6//
RHLBAAE/COMSOCSOUTH QUARRY HEIGHTS PM//J6//
RUCOBBA/COMSOCLANT NORFOLK VA//J6//
RUERNMO/PM SATCOM FT MONMOUTH NJ//SFAE/CM//
RUEJCCA/DIR JIEO WASHINGTON DC//TA/TB//
RUEJDCA/DISA WASHINGTON DC//CFE/UTTM/MSO//
RUERNMO/DIR JIEO FT MONMOUTH NJ//TBB/TBBA//
RUCJJCS/CDRJCSE MACDILL AFB FL//CC//
RHCGGAA/CDRSIGCEN FT GORDON GA//CG/ATZH-DC//
RUCJICD/DISA FLD OFC MACDILL AFB FL
RHCGSRB/COMUSARCENT FT MCPHERSON GA//G6//
RUCISBA/USCENTAF SHAW AFB SC//A6//
RUCJNAV/DEPCOMUSNAVCENT MACDILL AFB FL//N6//
RUCJAAA/USCINCSOC MACDILL AFB FL//SOJ6/J6I/J6O/J3R//

ACTION CA   ADDR BY 11
INFO   TA* TB TE UTTM TD ADA

THIS MESSAGE IS A CORRECTED COPY.

RUCJAAA 6089   2 3 1 3 0 0 Z SEP 94

BT
UNCLAS
MESSAGE IS A COMPOSITE OF RECEIVED SECTIONS
  033237 033238
MSGID/GENADMIN/USSOCOM SOJ6-I//
SUBJ/UHF DAMA MEETING RESULTS//
REF/A/MTG/SIGCEN/070000ZSEP94/-/NOTAL//
REF/B/MTG/USSOCOM/080000ZSEP94/-/NOTAL//
NARR/REF A WAS SIGCEN MEETING HELD TO SCOPE ARMYS VIEW ON UHF DAMA
ISSUES. REF B WAS USSOCOM/USCENTCOM MEETING TO DISCUSS UHF DAMA
ISSUES.//
POC/BARNES/MAJOR USAF/SOJ6-I/LOC MACDILL AFB FL/TEL DSN 968-4011//
RMKS/1. THE PURPOSE OF THIS USCENTCOM/USSOCOM COORDINATED MESSAGE
IS TO PROVIDE RECOMMENDATIONS DERIVED FROM THE 8 SEP 94 UHF DAMA
MEETING HELD AT MACDILL AFB FL. WE CONSIDER UHF SATCOM A NATIONAL
RESOURCE CRITICAL TO SUCCESSFUL EXECUTION OF OUR MILITARY OPERATIONS.
WE DEFINITELY SUPPORT EFFORTS TO IMPROVE UHF SATCOM OPERATIONAL
EFFECTIVENESS. THE UHF DAMA PRESENTATION MR. PAPPAS, JIEO/TBBA,
PROVIDED TO USSOCOM, USCENTCOM, AND JCSE ON 8 SEP 94 WAS ENLIGHTENING
AND THOUGHT PROVOKING. CLEARLY THERE ARE MANY UHF DAMA ISSUES TO BE
RESOLVED BEFORE DAMA MAY ADEQUATELY SUPPORT THE NEEDS OF ALL USERS.
WE CONSIDER SYSTEM CONTROL AND MANAGEMENT OF THIS RESOURCE TO BE KEY
ELEMENTS IN ADDRESSING THESE ISSUES. SOME ISSUES MAY BE RESOLVED
WITH BETTER USER EDUCATION. ALTHOUGH DAMA IMPLEMENTATION BY 1996 IS
DIRECTED, THE USER COMMUNITY HAS NOT BEEN FULLY EDUCATED ON DAMA
SERVICES, CAPABILITIES, AND ENVISIONED USE IN THE OPERATIONAL
ENVIRONMENT.
2. TO PRECLUDE DELAY IN THE IMPLEMENTATION OF MCM-89-94, WE CONCUR
WITH THE ARMY'S RECOMMENDATION DERIVED AT THE 7 SEP 94 SIGCEN MEETING
THAT A SOFTWARE SOLUTION BE PURSUED AS THE P3I UPGRADE FOR THE DAMA
WAVEFORM. WE ADVOCATE A P3I UPGRADE BE INITIATED SOON SO THE
NECESSARY IMPROVEMENTS WILL BE FIELDED WITH THE INTENT OF MEETING
THE MANDATORY DATE FOR DAMA OPERATIONS.
3. WE UNDERSTAND THE FUTURE UHF SATCOM SYSTEM WILL HAVE SEVERAL
LEVELS OF SERVICE AVAILABLE FOR BOTH 5KHZ AND 25KHZ CHANNELS. THE
HIGHEST CLASS OF SERVICE IS DEDICATED SINGLE ACCESS, FOLLOWED BY
DEMAND ASSIGNED SINGLE ACCESS (DASA), AND THEN DEMAND ASSIGNED
MULTIPLE ACCESS (DAMA) CHANNELS. CHANNELS WITH THE LEAST AMOUNT OF
TIME DELAY SHOULD BE ALLOCATED TO THE MOST CRITICAL USERS. WE
BELIEVE THE WARFIGHTERS ACTIVELY ENGAGED OR UNDER IMMINENT THREAT OF
ENGAGEMENT SHOULD RETAIN THE HIGHEST PRIORITY CHANNELS (IE DEDICATED
SINGLE ACCESS OR DASA) WHICH OFFER ZERO PUSH-TO-TALK TIME DELAY. WE
ENVISION DEDICATED AND DASA USAGE TO BE THE EXCEPTION, RATHER THAN
THE RULE, IN OVERALL DAMA OPERATIONS. IN ADDITION, PROCEDURES FOR
PREEMPTION AND COMMUNICATIONS REESTABLISHMENT ON LOWER CLASSES OF
SERVICE MUST BE CONSIDERED. RECOMMEND DISA REVIEW AND PRIORITIZE UHF
SATCOM USER REQUIREMENTS, TO INCLUDE ANALYSIS OF PREDICTED USAGE FOR
THE DEDICATED, DASA, AND TDMA/DAMA MODES OF THE 5KHZ AND 25KHZ
CHANNELS AT VARYING DATA RATES, AGAINST DOD PRIORITIES AND CURRENT
ALLOCATION SCHEMES.

4. MAJOR ISSUES OF CONCERN WITH PROPOSED SOLUTIONS FOLLOW
A. DAMA WAVEFORMS.
(1) DIFFERING FRAMES AND FORMATS. THE 5KHZ AND 25 KHZ DAMA
WAVEFORMS HAVE DIFERENT FRAME SIZE AND FORMATS, WHICH PREVENT
OPERATIONAL USERS FROM ACHIEVING SEAMLESS TRANSITION FROM ONE
SERVICE TO THE OTHER. RECOMMENDATION STANDARDIZE TO A SINGLE
PROTOCOL AND FRAME TO ALLOW SEAMLESS TRANSITION. IN ADDITION TO
IMPROVING EFFICIENCY AND REDUCING TERMINAL COMPLEXITY AND COST,
THIS SOLUTION WILL ALLEVIATE THE NEED FOR RESYNCHRONIZATION WHEN
MOVING FROM CHANNEL TO CHANNEL.
(2) DIFFERING CRYPTO PERIODS. THE 5KHZ AND 25KHZ DAMA WAVEFORMS
HAVE DIFFERENT ORDERWIRE CRYPTO PERIODS WHICH WILL REQUIRE
RESYNCHRONIZATION AND POSSIBLY DIFFERENT KEYS DURING TRANSITION
BETWEEN 5KHZ AND 25KHZ NETWORKS. RECOMMENDATION MAKE THE TWO CRYPTO
PERIODS THE SAME. THIS WILL SAVE TIME, IMPROVE OPERATIONAL TRAINING,
REDUCE SYSTEM COMPLEXITY AND COST, AND REDUCE TECHNICAL DIFFICULTIES
IN MOVING TOWARD SEAMLESS 5KHZ AND 25KHZ CHANNEL OPERATIONS.
B. 5KHZ WAVEFORM DELAYS. THE CURRENT WAVEFORM, WHILE EFFICIENT IS
NOT EFFECTIVE AND RESULTS IN LONG DELAYS FOR VOICE AND DATA
COMMUNICATIONS. RECOMMENDATION INSTITUTE THE FOLLOWING CHANGES TO
THE 5KHZ WAVEFORM. THE ADVANCED UHF SATCOM MODEM PROGRAM, A USSCCOM
AND JIEO EFFORT CURRENTLY IN PROGRESS, IS EXPECTED TO PROVIDE THE
BASIS FOR A FUNDAMENTAL SOLUTION OF THESE RECOMMENDED CHANGES.
(1) DECREASE THE FRAME DURATION. REDUCE THE FRAME SIZE TO ONE FOURTH
OR SHORTER OF THE PRESENT SIZE.
(2) MAINTAIN BANDWIDTH EFFICIENCY. USE ADVANCE MODULATION
TECHNIQUES TO MAINTAIN CHANNEL EFFICIENCY VIA SOFTWARE CHANGES. THE
SOFTWARE CHANGES, INSTALLED AS A P3I UPGRADE, WILL LESSEN THE IMPACT
ON EQUIPMENT FIELDING PLANS.
(3) RESTRUCTURE WAVEFORM. RESTRUCTURE THE WAVEFORM TO ALLOW
TRANSITION FROM ONE CHANNEL TO ANOTHER WITHOUT REQUIRING
RESYNCHRONIZATION.
C. SYSTEM MANAGEMENT AND CONTROL.
(1) MIL-STD-188-185. CURRENTLY, UNIFIED COMMANDS ARE NOT INVOLVED IN
DEFINING AND WRITING THE DAMA CONTROL SYSTEM AND MANAGEMENT STANDARD.
RECOMMENDATION ALL UNIFIED COMMANDS AND SERVICES BE INVOLVED IN THE
DEFINITION OF MIL-STD-188-185 TO ENSURE USER REQUIREMENTS ARE MET.
(2) CONTROLLER DEVELOPMENT. THE 5KHZ CONTROLLER IS UNDER PROGRAM
MANAGEMENT OF THE AIR FORCE AND THE 25KHZ CONTROLLER IS UNDER PROGRAM
MANAGEMENT OF THE NAVY. THERE IS DUPLICATION OF TECHNICAL EFFORT AND
THE POSSIBILITY OF UNCOORDINATED SOLUTIONS. RECOMMENDATION COMBINE
THESE TWO PROGRAMS UNDER A SINGLE JOINT PROGRAM OFFICE. A SINGLE
INTEGRATED MULTICHANNEL CONTROL SYSTEM WILL PROVIDE BETTER
INTEROPERABILITY, MORE EFFICIENCY, REDUCED COSTS, AND MOST
IMPORTANTLY AN EFFECTIVE SOLUTION FOR THE OPERATIONAL USERS.
3) CENTRAL CONTROL AND MANAGEMENT. CURRENT PLANS ADVOCATE
CENTRALIZED SYSTEM CONTROL AND CENTRALIZED MANAGEMENT OF
DISTRIBUTED SATCOM ASSETS. THE CENTRALIZED SYSTEM CONTROL IS
ACCEPTABLE HOWEVER, CENTRALIZED MANAGEMENT OF DISTRIBUTED SATCOM
ASSETS IS OPERATIONALLY UNACCEPTABLE. RECOMMENDATION ALLOW THE

USER TO RETAIN MANAGEMENT OF ASSIGNED SATCOM CHANNELS AND CHANNEL
ORDERWIRES TO ENSURE OPERATIONAL EFFECTIVENESS IS MAXIMIZED.
(4) SILENT MODE HANDOFF. PLANNED SILENT MODE OPERATIONS REQUIRE
HANDOFF WHEN MOVING FROM ONE CONTROLLER AREA TO ANOTHER. CURRENT
PLANS INDICATE THE NECESSITY FOR SILENT MODE USER TO IDENTIFY
HIMSELF, THUS VOIDING THE SILENT MODE OPERATION. RECOMMENDATION
LINK CONTROLLERS ELECTRONICALLY TO PROVIDE AUTOMATIC HANDOFF OF
SILENT MODE USERS.
5. USCENTCOM AND USSOCOM ARE FULLY COMMITTED TO OPERATING
IN THE UHF DAMA ENVIRONMENT. WE WELCOME EVERY OPPORTUNITY TO
ASSIST IN RESOLVING IDENTIFIED ISSUES. //
BT
RAAUZDSW RUCJAAA6089 2651904 MTMS-UUUU   NNNN

RAAUZYUW RUAGNVT1306 2990158-UUUU--RUERMOO.
ZNR UUUUU
R 260226Z OCT 94
FM COMUSKOREA SEOUL KOR//FKJ6//
TO RUHQHQB/USCINCPAC HONOLULU HI//J6//
INFO RUEADWD/HQDA WASHINGTON DC//DAMO-FDC/SAIS-SDX//
RUENAAA/CNO WASHINGTON DC//N6/N63//
RUEAHQA/HQ USAF WASHINGTON DC//SCM/XO//
RUEACMC/CMC WASHINGTON DC//C4I//
RUERMOO/PM SATCOM FT MONMOUTH NJ//SFAE/CM//
RUEJDCA/DISA WASHINGTON DC//CFE/UTTM/MSO//
RUERMOO/DIR JIEO FT MONMOUTH NJ//TBB/TBBA//
RHCGGAA/CDRSIGCEN FT GORDON GA//CG/ATZH-DC//
BT
UNCLAS
SUBJ: WARFIGHTER DAMA CONCERNS

. USFK IS FAMILIAR WITH NUMEROUS MESSAGES ADDRESSING CONCERNS
ABOUT UHF SATCOM DAMA DEVELOPMENT AND ITS RELATED ISSUES. WE
FAITHFULLY ACKNOWLEDGE AND TOTALLY SUPPORT YOUR EFFORTS TO KEEP THE
ATTENTION OF ALL CONCERNED FOCUSED ON THE END PRODUCT TO SUPPORT

PAGE 02 RUAGNVT1306 UNCLAS
WARFIGHTER REQUIREMENTS. IT IS PARAMOUNT THAT THE WARFIGHTER
REQUIREMENT AND SURVIVABILITY TAKE PRECEDENCE OVER OTHER ISSUES
THROUGHOUT THE DEVELOPMENT OF UHF SATCOM DAMA EQUIPMENT AND ITS
CONCEPT OF OPERATIONS.
. FROM A USFK PERSPECTIVE, PROVIDING COMMANDERS WITH A
DECENTRALIZED, RELIABLE AND RAPID CAPABILITY TO COMMAND AND CONTROL
THEIR FORCES AT A DECISIVE MOMENT ON THE BATTLEFIELD CONSTITUTES A
CRITICAL WARFIGHTER FORCE ENHANCEMENT. THE INHERENT TECHNICAL
CAPABILITY UHF SATCOM DAMA PROVIDES WILL ALLOW US TO TRIPLE OR
QUADRUPLE OUR SATCOM COMMUNICATIONS TO C2 SUBORDINATE COMMANDERS.
THIS IS WITHOUT DOUBT PROGRESS IN LIGHT OF THE LIMITED SATELLITE
RESOURCES ACCESSIBLE/ALLOCATED FOR OUR USE. CONVERSELY, COMMANDERS
EQUIPPED WITH NEW UHF SATCOM DAMA EQUIPMENT THAT INCORPORATES A MORE
STRINGENT AND BURDENSOME CONOPS AND GREATER DELAYS IN OPERATION THAN
OUR PRESENT SATCOM EQUIPMENT, DETRACTS FROM ANY POTENTIAL WARFIGHTIN
ENHANCEMENT AND IS NOT ACCEPTABLE.
. WE MUST ALSO NOT FORGET THE OVERALL IMPACT ON THE JOINT COMMUNIT
WHEN INTRODUCING UHF DAMA SATCOM EQUIPMENT. THE PASSING OF EACH DAY
IS EVIDENCE TO THE USFK STAFF OF OUR NEED TO FULLY INTEGRATE ALL
ASPECTS OF JOINT ARMISTICE AND CONTINGENCY WARFARE OPERATIONS. THE

PAGE 03 RUAGNVT1306

DEVELOPMENT OF UHF SATCOM DAMA IS A CLASSIC EXAMPLE OF A JOINT ARENA
ASSET WHOSE STRENGTH'S CAN EASILY AND QUICKLY BECOME DILUTED IF
SERVICE PAROCHIALISM IS ALLOWED DURING ITS INCEPTION. ALL ASPECTS OF
DAMA DEVELOPMENT MUST BE AN ABOVE-THE-BOARD JOINT ENTERPRISE WHOSE
END RESULT INCORPORATES EACH SERVICE'S REQUIREMENT. THIS IS
CERTAINLY NOT AN EASY TASK, BUT ONE WHICH MUST BE ACCOMPLISHED. IT
IS INCUMBENT ON THOSE INVOLVED IN RESOLVING THIS ISSUE, THAT EACH
SERVICE REQUIREMENT BE FULLY DEFINED, ADDRESSED AND SUPPORTED TO THE
FULLEST EXTENT WITHIN TECHNICAL PARAMETERS.
. USFK IS AWARE OF AND APPRECIATES YOUR EFFORTS TO DATE TO VOICE
UHF SATCOM DAMA CONCERNS. WE ENCOURAGE YOU TO CONTINUE YOUR EFFORTS
IN KEEPING ALL INVOLVED COGNIZANT OF OUR CONCERNS AS JOINT
WARFIGHTERS.
. USFK J6 POC IS MAJ JAMES WINBUSH, DSN 723-3305.

BT

-   ...not a command(type ? for help)
-   ...not a command(type ? for help)
- delete

(JIEO)   SC

RTAUZYUW RUHQSGG6445 2443000-UUUU--RUERNMO.
ZNR UUUUU
R 082000Z SEP 94   ZYB
FM USCINCPAC HONOLULU HI//J6//
TO RUEHJCS/JOINT STAFF WASHINGTON DC//J61/J6N//
INFO RUEADWD/DA WASHINGTON DC//DAMO-FDC/SAIS-SDX//
RUENAAA/CNO WASHINGTON DC//N6/N63//
RUEAHQA/HQ USAF WASHINGTON DC//SCM//
RUEACMC/CMC WASHINGTON DC//C4I//
RUCBSAA/CINCUSACOM NORFOLK VA//J6//
RUCJACC/USCINCCENT MACDILL AFB FL//CCJ6//
RUSNNOA/USCINCEUR VAIHINGEN GE//ECJ6//
RHLBAAA/USCINCSO QUARRY HEIGHTS PM//SCJ6//
RUWTNOK/USCINCSPACE PETERSON AFB CO//SPJ4-J6//
RUCJAAA/USCINCSOC MACDILL AFB FL//SOJ6/SODC//
RUCUSTR/USCINCSTRAT OFFUTT AFB NE//J6//
RHCUAAA/USCINCTRANS SCOTT AFB IL//TCJ6//
RUEHC/SECSTATE WASHINGTON DC//IM-DLO//
RUEJDCA/DISA WASHINGTON DC//CFE/UTTM/MSO//
RUETIAA/DIRNSA FT GEORGE G MEADE MD//Q2/G56//
RULSSPA/COMSPAWARSYSCOM WASHINGTON DC//PD50/PD51//
RUERGAA/CDRSIGCEN FT GORDON GA//ATZH-DC/ATZH-TS/ATZH-CDM//

①

PAGE 02 RUHQSGG6445 UNCLAS
RUERNMO/DIR JIEO FT MONMOUTH NJ//TBB/TBBA//
RULSMCA/COMMARCORSYSCOM QUANTICO VA//C2CMS//
RUERNMO/FM SATCOM FT MONMOUTH NJ//SFAE-CM-SC//
RUCUAAA/OL A HQ AFSPACECOM OFFUTT AFB NE//SCZ//
RUWASPC/COMARSPACE COLORADO SPRINGS CO//MOSC-IA//
RULSLAC/COMNAVSPACECOM DAHLGREN VA//N3//
RUEOFFA/ESC HANSCOM AFB MA//MSP//
ZEN/CDR WHCA WASHINGTON DC//IM/SO/DLD//
RUCJJCS/CDRJCSE MACDILL AFB FL//JCSE-XR//
ZEN/7CG WASHINGTON DC//SMCO//
RULSWCB/COMNAVCOMTELCOM WASHINGTON DC//N3/N5//
RUWFOAA/NCCOSC RDTE DIV SAN DIEGO CA//84//
BTA3
UNCLAS   //N02050//

MSGID/GENADMIN/USCINCPAC J6/901/SEP//
SUBJ/5 KHZ DAMA VOICE FIX FOR THE WARFIGHTER//
REF/A/GENADMIN/USSOCOM SOJ6-I/261234ZAUG94/-/NOTAL//
REF/B/MTG/USASIGCEN DCD/940816/-/NOTAL//
REF/C/GENADMIN/CDR SIGCEN/221125ZJUL93/-/NOTAL//
REF/D/GENADMIN/USSOCOM SOJ6/121800ZOCT93/-/NOTAL//

PAGE 03 RUHQSGG6445 UNCLAS
REF/E/GENADMIN/JOINT STAFF J61/222300ZJUL94//
REF/F/GENADMIN/USSOCOM SOJ6-I/011605ZAUG94/-/NOTAL//
REF/G/GENADMIN/JOINT STAFF J61/152300ZAUG94//
NARR/REF A ANNOUNCED 8 SEP JOINT STAFF AND JIEO MTG AT SOCOM TO
DISCUSS REMAINING UHF DAMA TECHNICAL ISSUES. REF B WAS MTG BETWEEN
SIGCEN DCD AND USAF ESC 5KHZ DAMA CONTROLLER DEVELOPERS. REF C WAS
ARMY CONCERNS ABOUT WARFIGHTER USE OF 5KHZ CHANNELS. REF D WAS
USCINCSOC OPERATIONAL REQMT FOR ZERO TIME DELAY FOR SPECIAL
OPERATIONS FORCES. REF E WAS JOINT STAFF COMMITMENT TO FIND WAYS TO
MINIMIZE 5 KHZ DAMA VOICE DELAYS AND TO PROVIDE AN ACCEPTABLE INTERIM
SOLUTION. REF F WAS USCINCSOC REITERATION OF REQUIREMENT FOR ZERO
TIME DELAY ON 5KHZ DAMA CHANNELS. REF G WAS JOINT STAFF
ACKNOWLEDGEMENT OF REF D AND COMMITMENT TO PROVIDE EITHER ACCEPTABLE
5KHZ DAMA SERVICE OR PROVIDE FOR DEMAND ASSIGNED SINGLE ACCESS (DASA)
CHANNELS TO AUTHORIZED USERS.//
POC/G.E. PETERSEN/LTC/USCINCPAC J621/LOC:CAMP H.M. SMITH HI
/SECTEL:DSN 315-477-6127/TEL:FAX 4110//
RMKS/1. PACOM STRONGLY ENDORSES YOUR EFFORTS TO RESOLVE UHF SATCOM
DAMA ISSUES AT THE MEETING ANNOUNCED IN REF A. SEVERAL PROBLEMS
CONCERNING THE ABILITY OF THE 5KHZ UHF DAMA CONTROLLER TO MEET

PAGE 04 RUHQSGG6445 UNCLAS
DAMA REQUIREMENTS WERE HIGHLIGHTED AT A RECENT SIGCEN MEETING
WITH USAF ELECTRONIC SYSTEMS CENTER PERSONNEL WHO ARE DEVELOPING
A 5KHZ UHF DAMA CONTROLLER (REF B). IN SPITE OF THE MANY ISSUES
CONCERNING DAMA IMPLEMENTATION, WE WANT TO TAKE THIS OPPORTUNITY
TO REQUEST THAT YOU KEEP YOUR PRIMARY FOCUS ON THE END RESULT FOR
WARFIGHTERS.

2. FACOM ECHOES THE CONCERNS EXPRESSED IN REFS C, D, AND F REGAF
2. FACOM ECHOES THE CONCERNS EXPRESSED IN REFS C. D, AND F REGAF
2. FACOM ECHOES THE CONCERNS EXPRESSED IN REFS C, D. AND F REGAF
THE CRUCIAL DEVELOPMENTAL PROCESS FOR A SUITABLE 5KHZ UHF DAMA S
ACCESS FOR WARFIGHTERS. ADVERTISED BENEFITS LIKE ACHIEVING A 300
PERCENT IMPROVEMENT IN TECHNOLOGY (REF E) OR THAT THE CONVERSION
DAMA TECHNOLOGY PROVIDES A 400 PERCENT INCREASE IN USER ACCESS
(REF G) SHOULD NOT DIVERT US FROM OUR FIRST PRIORITY.
3. WE ASK THAT THE DEVELOPMENT AND CONOPS FOR UHF DAMA BE PRIMAF
FOCUSED ON THE NEEDS AND THE SURVIVABILITY OF WARFIGHTERS. AFTER
FRAME DURATION, CALL SETUP, AND PUSH-TO-TALK (PTT) DELAYS ARE
MINIMIZED AND JUDGEMENTS ARE MADE AS TO WHO GETS DASA, THE ENTIF
TECHNICAL SOLUTION REQUIRES EXAMINATION IN THE CONTEXT OF THE
EXPECTED USER POPULATION AND SATCOM CONOPS. THE FINAL ANALYSIS (
SYSTEM EFFICACY SHOULD NOT BE JUDGED ON INDIVIDUAL TECHNICAL
PARAMETERS SUCH AS 2 SECOND PTT DELAY OR EIGHT SECOND INITIAL C/

PAGE 05 RUHQSGG6445 UNCLAS
SET-UP, BUT SHOULD INSTEAD FOCUS ON WHAT THE COMBINED EFFECT OF
PARAMETERS WILL BE ON THE ABILITY OF THE FORCE COMMANDER TO TALK
HIS SUBORDINATE COMMANDERS IN A TIMELY FASHION WHILE MAINTAINING
OPSEC. ONE SIGNIFICANT ISSUE SHOULD BE A DETERMINATION OF THE T:
DELTA BETWEEN BOTH CHANNEL ACCESS AND CALL SET-UP PERIOD WHEN
COMPARING THE HIGHEST PRIORITY USER TO THE LOWEST PRIORITY. THE
OUTCOME SHOULD BE UNDERSTOOD AND ACCEPTABLE TO WARFIGHTERS WHO I
OPERATE AND SURVIVE WITH OUR SOLUTION.
4. FACOM APPRECIATES EFFORTS TO DATE AND UNDERSTANDS THE DEGREE
DIFFICULTY WITH THE TASK AT HAND. REGRET WE WILL NOT HAVE A
REPRESENTATIVE ATTENDING THE MTG MENTIONED IN REF A, BUT REQUEST
YOU CONTINUE TO WORK TOWARD NOT ONLY A TECHNICALLY SUPERIOR SOLL
BUT ONE THAT IS FIRST AND FOREMOST OPERATIONALLY SOUND.//
BT
#6445
NNNN

APPENDIX E

USMCEB AND JOINT STAFF MESSAGES

TB
READ FILE
Andy

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RTTUZYUW RUEKJCS2523 1581659 MTMS-UUUU--RUEJDCA.1581704 078182 06-07-94
ZNR UUUUU
R 060705Z JUN 94
FM USMCEB WASHINGTON DC
TO RUEHC/SECSTATE WASHINGTON DC//CIP/IM-DLO//
RUEKJCS/SECDEF WASHINGTON DC//ASD C3I//
RUEADWD/DA WASHINGTON DC//SAIS-ZA/C4X/SM/MCEB//
RUENAAA/CNO WASHINGTON DC//N6/N61//
RUEAHQA/HQ USAF WASHINGTON DC//SC/SCXX/XOFI//
RUEACMC/CMC WASHINGTON DC//C4I//
RULSJGA/COMDT COGARD WASHINGTON DC//G-T//
RUCBSAA/CINCUSACOM NORFOLK VA//J6//
RUCJACC/USCINCCENT MACDILL AFB FL//CCJ6//
RUSNNOA/USCINCEUR VAIHINGEN GE//ECJ6//
RUHQHQB/USCINCPAC HONOLULU HI//J6/J61//
RUWTNOK/USCINCSPACE PETERSON AFB CO//J4-6/J60//
RHLBAAA/USCINCSO QUARRY HEIGHTS PM//SCJ6//
RUCJAAA/USCINCSOC MACDILL AFB FL//SOJ6//
RUCUSTR/USCINCSTRAT OFFUTT AFB NE//J6//
RHCUAAA/USCINCTRANS SCOTT AFB IL//TCJ6//
RUETIAA/DIRNSA FT GEORGE G MEADE MD//DDI/DDT/I11/Q11/X88//
RUEJDCA/DISA WASHINGTON DC//AA/FA/DISM/UT//
RULKDMA/HQ DMA FAIRFAX VA//D/IS/TI//
RUEKJCS/DIA WASHINGTON DC//SC/SY/MB//
RUEPGCO/GSA INFO SEC MGMT DIV WASHINGTON DC//KYI//
RUEJDCA/DIR JIEO WASHINGTON DC//TA/TB/TX/TBBA/UFDD//
RUEAIIA/CIA WASHINGTON DC//CMS//
RUEJNCS/MGR NCS WASHINGTON DC//NCS-NEE//
INFO RUEAHUA/CDRUSAISC FT HUACHUACA AZ//ASCG//
RHCUABA/AFC4A SCOTT AFB IL//CC//
RULSWCB/COMNAVCOMTELCOM WASHINGTON DC//00//
RULSSAW/NAVINFOSYSMGTCEN WASHINGTON DC//00//
RUEPNMC/CDRCECOM FT MONMOUTH NJ//AMSEL-CG//
RUEAHUA/DIRJITC FT HUACHUCA AZ //TC/TCCB//
RUCJJCS/CDRJCSE MACDILL AFB FL//XR//
RHNVFFP/COMDT AFSC NORFOLK VA//JCEWS//
RUEBBGB/NAVPGSCOL MONTEREY CA//CODE CC//
RHHMHAH/CINCPACFLT PEARL HARBOR HI//N6//
RUCBCLF/CINCLANTFLT NORFOLK VA//N6//
RHDLCNE/CINCUSNAVEUR LONDON UK//N6//
```

Cmd Grp
CAMP
CFS 6/9
CT&E
CFE
CFA
CISS
CIM
CFI&I

FYI

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ACTION ADA          ADDR BY  04
INFO   FA UT TB TA* NCS


RUEKJCS 2523                  0 6 0 7 0 5 Z JUN 94
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AND SOCOM OVER NEXT 60 DAYS
--- PROVIDE TO MCEB FINAL APPROVED COPY OF CONCEPT OF
OPERATIONS NLT 15 AUG 94
-- LEAD OVERALL EFFORT FOR INTEROPERABLE MAP SOFTWARE
D. JOINT WARRIOR INTEROPERABILITY DEMONSTRATION (JWID) 94, USAF
- MCEB APPRECIATES USAF AND USACOM EFFORTS
- JOINT STAFF WILL
-- PROGRAM AND BUDGET FOR JWID OVERHEAD COSTS FOR FY96
AND OUT
- USMC AND USA WILL
-- EXECUTE JWID 95 AND JWID 96 RESPECTIVELY AS LEAD SERVICE
E. AGILE PROVIDER 94, REVISED BATTLEFIELD ELECTRONIC CEOI
SYSTEM (RBECS), USACOM
- MCEB APPRECIATES USACOM'S USE OF RBECS AND PROVIDING
USER FEEDBACK
- JOINT STAFF (J61) WILL TAKE OVERALL LEAD FOR FIXES
- J6K WILL
-- DEVELOP CHAIRMAN, JOINT CHIEFS OF STAFF INSTRUCTION
(CJCSI) ON USE OF UMBRELLA JCEOI SYSTEM
--- CJCSI WILL BE AVAILABLE IN DRAFT NLT 1 JUL 94
- J6J WILL
-- ENSURE SOFTWARE ENHANCEMENTS TO PROVIDE ENCODE/DECODE
CAPABILITY ARE COMPLETED NLT JAN 95
-- ENSURE DATA TRANSFER DEVICE COMPATIBILITY ENHANCEMENTS
TO PERMIT INTERSERVICE EXCHANGE ARE COMPLETED NLT JAN 95
-- PROVIDE AN IN-PROGRESS REVIEW BRIEF AT 29 AUG 94 MCEB
--- FURTHER, REPORT RESULTS FROM 21 JULY 94
CONFIGURATION CONTROL BOARD (CCB) MEETING
- J62 CINC DIVISIONS WILL
-- IDENTIFY OTHER OPPORTUNITIES (EXERCISES) IN WHICH RBECS
COULD BE IMPLEMENTED AS A JOINT SYSTEM TO FURTHER REFINE
AND DEVELOP THE SYSTEM AS A JOINT WARFIGHTER TOOL TO J6J
NLT 22 JUN 94
F. UHF SATCOM DEMAND ASSIGNED MULTIPLE ACCESS (DAMA), JIEO
- MCEB ENDORSES DISA (JIEO) STRATEGY FOR 5 KHZ DAMA FIX
-- INTERIM FIX - ASSIGN CRITICAL USERS TO DEDICATED 5 OR 25
KHZ CHANNELS, OR 25 KHZ DAMA CHANNELS ONLY
- JIEO WILL
-- REDESIGN 5KHZ DAMA WAVEFORM FOR FINAL FIX
-- PUBLISH REVISED MIL-STD (SEP 96 OR SOONER)
-- PROVIDE SOFTWARE UPGRADE FOR DAMA TERMINALS (DEC 96
OR SOONER)
-- SEEK WAYS TO ACCELERATE STRATEGY
- CINCS AND SERVICES WILL
--- PROVIDE FUNDING FOR REDESIGN OF WAVEFORM' REVISION OF
MIL-STD AND TERMINAL UPGRADES
-- PERFORM UPGRADE ON DAMA TERMINALS WITH DISA (JIEO)
ASSISTANCE (MAR 97 OR SOONER)
- MCEB REITERATED PREVIOUS DECISION FOR USAF AND USN TO
DEVELOP MOU TO COORDINATE EFFORTS ON A JOINT INTEGRATED

RULSSPA/COMSPAWARSYSCOM WASHINGTON DC//00//
RUHVPAC/HQ PACAF HICKAM AFB HI//SC//
RHFQAAA/HQ USAFE RAMSTEIN GE//SC//
RHDIAAA/HQ ACC LANGLEY AFB VA//SC//
RUEOFFA/ESD HANSCOM AFB MA//CC//
RUFDAAA/CINCUSAREUR HEIDELBERG GE//AEAIM//
RUAGAAA/CDRUSAEIGHT SEOUL KOR//J6//
RULSMCA/COMMARCORSYSCOM QUANTICO VA
RULSMCA/MARCORCOMTELACT QUANTICO VA
RULSMCA/CG MCCDC QUANTICO VA
RUCBLFA/COMMARFORLANT//G-6//
RUHQHQC/COMMARFORPAC//G-6//
RHCGSRB/CDRFORSCOM FT MCPHERSON GA//FCG6//
RHCGGAA/CDRSIGCEN FT GORDON GA//ATZH-CG//
RULSSPA/COMSPAWARSYSCOM WASHINGTON DC//30E//
RUEHNO/USDELMC BRUSSELS BE//C4I//
BT
UNCLAS
MESSAGE IS A COMPOSITE OF RECEIVED SECTIONS
  078182 078184 078183
CIA FOR CMS (ATTN STEVE SCHANZER)
MSGID/GENADMIN/USMCEB//
SUBJ/SUMMARY OF 31 MAY 94 UNITED STATES MILITARY
/COMMUNICATIONS-ELECTRONICS BOARD (USMCEB) MEETING//
POC/W.P. FAIRBANKS/DEPMILSEC/PENTAGON RM 1E833/-/TEL DSN 224-7922
/TEL CMCL(703)614-7922//
RMKS/1. THIS MESSAGE PROVIDES EXECUTIVE SUMMARY RESULTS OF RECENTLY
COMPLETED USMCEB PRINCIPALS MTG. ALL SERVICES AND AGENCIES WERE
REPRESENTED. USACOM (J6 REP), USSTRATCOM (J6 REP), USCENTCOM (J6 REP)
AND USTRANSCOM (J6 REP) OBSERVED. KEY DECISIONS SUMMARIZED IN
PARA 2. PARA 3 PRESENTS BRIEF OVERVIEW OF BRIEFINGS AND DISCUSSIONS.
2. DECISION SUMMARY
    A. EVOLUTION OF JOINT REQUIREMENTS OVERSIGHT COUNCIL (JROC), JS
        - MCEB APPRECIATES BRIEFING AND WILL WORK TO SUPPORT NEW JROC
          PROCESS THROUGH EXISTING PANEL STRUCTURE
    B. GLOBAL COMMAND AND CONTROL SYSTEMS, JS
        - GOOD OVERVIEW BRIEFING
        - OASD(C3I) REQUESTED TO
          -- SCHEDULE BRIEF TO APPROPRIATE OSD STAFF WITHIN TWO WEEKS
             --- MCEB PRINCIPALS ARE INVITED AND ENCOURAGED TO ATTEND
        - J6V WILL
          -- CONTINUE TO WORK TOWARDS FULL IMPLEMENTATION OF GCCS
          -- PROVIDE PERIODIC UPDATES TO MCEB
          -- CONTINUE TO SEEK USER FEEDBACK AND INCORPORATE INTO
             PROGRAM
    C. INTEROPERABLE MAP SOFTWARE, DMA
        - MCEB ENDORSES OVERALL APPROACH
        - DMA WILL
          -- SEEK INTELLIGENCE SYSTEMS BOARD (ISB) COORDINATION
          -- STAFF CONCEPT OF OPERATIONS WITH SERVICES, AGENCIES

- ALL WWMCCS AND GCCS PROGRAM ELEMENTS HAVE BEEN COMBINED
- NEED CONTINUED SUPPORT FOR GCCS
- C2 INITIATIVES THAT DO NOT DIRECTLY SUPPORT GCCS MUST BE
  DISCONTINUED

DISCUSSION POINTS
- J6 IS WORKING WITH CONGRESSIONAL COMMITTEE STAFFS ON C2
  SYSTEMS MIGRATION TO GCCS, ELIMINATION OF DUPLICITY ETC.
- WWMCCS TERMINATION WILL OCCUR ONCE GCCS FUNCTIONALITY
  IS DETERMINED TO BE ACCEPTABLE
- INVESTIGATION OF CONVERSION OF JOPES MAINTENANCE CONTRACT TO
  GCCS MIGRATION
- USACOM USED GCCS DURING HAITI CRISIS AND AGILE PROVIDER 94
  AND GAVE IT HIGH MARKS

C. INTEROPERABLE MAP SOFTWARE' DMA
   BRIEFING POINTS
   - DEFENSE INTELLIGENCE AGENCY MEMORANDUM, SUBJ OILSTOCK MAP
     DISPLAY SYSTEM AND DEPARTMENT OF DEFENSE INTELLIGENCE
     INFORMATION SYSTEM (DODIIS) AUTOMATED MAPPING APPLICATIONS,
     DTD 23 DEC 93 CAUSED ASD(C3I) TASKER, SUBJ MAP DISPLAY
     SYSTEMS, DTD 7 FEB 94 TO BE TRANSMITTED TO DIRECTOR, DEFENSE
     MAPPING AGENCY
   - NO EFFECTIVE JOINT CONTROL OVER MC-G EXPLOITATION SOFTWARE
     AND ALGORITHMS
   - DMA IS LEADING THE OVERALL EFFORT FOR INTEROPERABLE MAP
     SOFTWARE
   - DMA PLAN IS TO CERTIFY, DEVELOP, MAINTAIN, REENGINEER, AND
     PROMOTE REUSE OF EXPLOITATION SOFTWARE AND ALGORITHMS FOR
     DIGITAL MAPS
   - PLAN OF SOFTWARE & ALGORITHM CERTIFICATION AND SOFTWARE
     REUSE INTENDS TO ACHIEVE ASD(C3I) 1996 TARGET
     -- FURTHER ALLOWS FOR RAPID PROTOTYPING FOR PROGRAMS AT
        DECISION POINTS FOR MC-G EXPLOITATION
   - DMA WILL RUN CERTIFICATION PROCESS, OVERSEE AND ENSURE
     NEEDED REENGINEERING AND DEVELOPMENT, LINK AS A NODE TO
     DISA SOFTWARE REUSE LIBRARY AND STANDARDIZE APPLICATION
     PROGRAM INTERFACES (API'S) FOR JOINT MC-G EXPLOITATION
     SOFTWARE
- SOFTWARE WILL COMPLY WITH MC-G PROFILE ESTABLISHED WITHIN
  TECHNICAL ARCHITECTURE FRAMEWORK FOR INFORMATION MANAGEMENT
- UNDER DMA PLAN SOFTWARE DEVELOPERS WILL FOCUS SOFTWARE
  DEVELOPMENT ON FUNCTIONAL APPLICATIONS, USE STANDARD API'S,
  ENGINEER SOFTWARE FOR REUSE AND SUBMIT MC-G EXPLOITATION
  SOFTWARE AND ALGORITHMS TO DMA FOR CERTIFICATION
DISCUSSION POINTS
- DMA CERTIFICATION OF MC-G EXPLOITATION SOFTWARE AND
  ALGORITHMS DOES NOT INTERFERE WITH JITC INTEROPERABILITY
  CERTIFICATION. JITC WILL CONTINUE TO CONDUCT
  INTEROPERABILITY TESTS AND CERTIFY SYSTEMS FOR
  INTEROPERABILITY
- MCEB ENDORSEMENT OF OVERALL APPROACH DOES NOT CONSTITUTE

APPROVAL OF DMA CONCEPT OF OPERATIONS (CONOPS). DMA WILL
STAFF CONOPS AS SEPARATE ACTION OVER NEXT 60 DAYS
- NEED TO ENSURE CONTINUED INTEL COMMUNITY INVOLVEMENT

D. JOINT WARRIOR INTEROPERABILITY DEMONSTRATION (JWID) 94, USAF
BRIEFING POINTS
- JWID 94 IS FIFTH IN SERIES OF DEMONSTRATIONS DESIGNED TO
  SUPPORT AND FURTHER GOALS OF C4IFTW CONCEPT
- JWID DATES ARE 8 AUG 94 TO 1 SEP 94
- USAF IS LEAD SERVICE, AIR COMBAT COMMAND (ACC) IS EXECUTING
  COMMAND AND US ATLANTIC COMMAND (USACOM) IS HOST CINC
- 121 DEMOS WERE SUBMITTED BY OVER 30 DOD AGENCIES' CIVIL
  AGENCIES (I.E. FEMA) AND VENDORS
- 74 SURVIVED SCREENING PROCESS (22 SPONSORED BY COMMERCIAL
  VENDORS)
DISCUSSION POINTS
- USAF HAS FORMALIZED THE JWID PROCESS TO ASSIST OTHER LEAD
  SERVICES IN FUTURE PLANNING EFFORTS
- JWID 94 IS FIRST INVOLVEMENT OF FEMA AND NCS WORKING TO
  INVOLVE NEACP WITH GCCS TERMINAL
- SUCCESSFULLY ESTABLISHED DISCIPLINE IN PROCESS WHERE IT HAS
  PROCESS PARAMETERS AND BOUNDRIES
- JITC INVOLVEMENT ESSENTIAL AND NEED FOR PROCESS TO ENSURE
  SAME LESSONS ARE NOT LEARNED IN SUBSEQUENT YEARS TO BE
  INSTITUTIONALIZED

E. AGILE PROVIDER 94, REVISED BATTLEFIELD ELECTRONIC CEOI SYSTEM
(RBECS), USACOM
BRIEFING POINTS
- FIRST TIME THAT RBECS HAS BEEN USED TO GENERATE CINC AND
  COMPONENT CEOI AS PART OF UMBRELLA SYSTEM
- OBJECTIVES WERE
  -- PRODUCE USER FRIENDLY JCEOI IN A REASONABLE AMOUNT OF
     TIME THAT MEETS NEEDS OF COMMANDER
  -- EVALUATE EFFECTIVENESS OF FREQUENCY AND CALL SIGN
     ASSIGNMENT PROCESS
  -- EVALUATE EFFICIENCY OF REPRODUCTION/DISTRIBUTION PROCESS
- RESULTS WERE
  -- DEVELOPMENT OF UMBRELLA CEOI TOOK 18 DAYS
     --- LENGTHY PERIOD WAS ATTRIBUTED TO LEVEL OF EXPERIENCE
         WITH RBECS AND COMPUTER PLATFORM AND SOFTWARE
         PROBLEMS ENCOUNTERED
     --- ALSO EXPERIENCED PROBLEMS DOWNLOADING RBECS DATA TO
         JOINT SPECTRUM MANAGEMENT SYSTEM
  -- SOME ASSIGNMENT PROBLEMS WERE IDENTIFIED FOR CALL
     SIGNS AND FREQUENCIES BETWEEN COMPONENTS AND UMBRELLA
     JCEOI
  -- DISTRIBUTION WAS EFFECTED BY HAND DELIVERY. DIFFICULT TO
     REPRODUCE DUE TO SIZE AND AVAILABILITY OF REPRODUCTION
     ASSETS AT LOWER ECHELONS
- RBECS IS NOT READY TO BE USED FOR CONTINGENCY PURPOSES UNTIL
  SOFTWARE DEFICIENCIES HAVE BEEN RESOLVED

DISCUSSION POINTS
- J61 WILL LEAD EFFORT TO ACCOMPLISH ALL FIXES RECOMMENDED
  BY USACOM
- MCEB WILL MONITOR PROGRESS WITH FIRST IN-PROGRESS REVIEW AT
  29 AUG 94 MCEB
- NEED FOR CONTINUED REFINEMENT OF RBECS
F. UHF, SATCOM DEMAND ASSIGNED MULTIPLE ACCESS' JIEO
   BRIEFER POINTS
   - TWO PART BRIEFING
     -- DISA(JIEO) IMPLEMENTATION OF 5 KHZ DAMA DELAY FIX
        STRATEGY
     -- UPDATE ON JOINT INTEGRATED DAMA CONTROLLER EFFORT
   - CURRENT 5 KHZ WAVEFORM (MIL-STD-188-182) IS NOT SUITABLE FOR
     TIME CRITICAL VOICE REQUIREMENTS DUE TO LENGTHY ACCESS
     DELAYS
     -- USA AND CINCSOC EXPRESSED THAT DELAYS ARE NOT ACCEPTABLE
   - INTERIM FIX IS TO ASSIGN CRITICAL VOICE USERS TO DEDICATED
     5 OR 25 KHZ CHANNELS, OR 25 KHZ DAMA ACCESSES
   - FINAL FIX WILL REDESIGN 5KHZ DAMA WAVEFORM TO MINIMIZE
     DELAYS AND THEN UPGRADE DAMA TERMINALS USING A SOFTWARE
     FILL
   - PROPOSED SCHEDULE (COMPLETION DATE) FOR FINAL FIX
     -- ESTABLISH MAXIMUM ACCEPTABLE DELAYS - 1 JUL 94
     -- IDENTIFY POTENTIAL COST SOFTWARE SOLUTIONS - 1 SEP 95
     -- DEVELOP NEW WAVEFORM AND REVISE MIL-STD - 1 SEP 96
     -- UPGRADE TERMINALS - MAR 97
   - ESTIMATED COST FOR REVISING WAVEFORM AND MIL-STD $650K
   - SOFTWARE UPGRADE TO EMUT AND OTHER DAMA TERMINALS WILL BE
     APPROX $700 PER TERMINAL
   - CINCS AND SERVICES TO PROVIDE FUNDING
   DISCUSSION POINTS
   - CURRENT 5KHZ DAMA WAVEFORM WILL CAUSE 30 SEC VOICE DELAY IN
     CONNECTION
   - SOLUTION REQUIRED PRIOR TO 1997 EXPEDITE PROCESS
4. PAPERS PRESENTED (COPIES AVAILABLE FROM USMCEB)
   A. DISN, DISA
   - PAPER PROVIDED UPDATE ON DISN ACCELERATION PLAN
   - TOTAL NUMBER OF CIRCUITS ON DISN IS 4098
   - NUMBER FALLS SHORT PROJECTED GOAL
   - NEED SUPPORT IN ADDRESSING URGENCY AND NECESSITY OF EXPEDITING
     DISN CIRCUIT IMPLEMENTATION AT BASE/POST/CAMP LEVEL
   B. INTEGRATION DEFINITION (IDEF) MODELING, OASD(C3I)
   - ISSUE SURFACED AT 28 FEB 94 MCEB
   - OASD(C3I) WAS TO EVALUATE IF DOD POLICY NEEDED DECONFLICTION
     BETWEEN IDEF AND INFORMATION ENGINEERING TOOLS SUCH AS
     FINKELSTEIN METHOD IN DATA MODELING
   - PAPER CONCLUDES THAT THERE IS NO CONFLICT
   C. DSCS SNAPBACK PLAN, DISA
   - PAPER PROVIDED UPDATE ON 22 FEB 94 MCEB TASKER TO DISA
   - DISA IN COORDINATION WITH USSTRATCOM HAS DEVELOPED DRAFT

SNAPBACK PLAN
- USSTRATCOM HAS DEVELOPED TEST PLAN AND PROVIDED TO J6
  REQUESTING TEST PLAN BE MADE PART OF SNAPBACK PLAN
- FINAL CHANGES WILL BE MADE & JOINT ACTION WILL FOLLOW
  TO VALIDATE PLAN
D. DOD DATA ADMINISTRATION TASK FORCE REPORT, JIEO
- PROGRESS HAS SLOWED PARTIALLY DUE TO TIME REQUIRED FOR JOPES
  MODEL VALIDATION
- THREE VERSIONS OF JOPES MODEL IN EXISTENCE, DETERMINATION WAS
  MADE THAT SEP 93 BEST DEPICTED CURRENT JOPES ENVIRONMENT
- PROJECT IS BEHIND SCHEDULE BUT POSSIBILITY EXISTS THAT SOME
  TIME CAN BE MADE UP
E. JOINT SPECTRUM CENTER STATUS REPORT, JSC
- PAPER PROVIDED UPDATE ON PROGRESS BEING MADE IN THE
  ESTABLISHMENT OF THE JOINT SPECTRUM CENTER
- JOINT ACTION IS OUT TO REACH AGREEMENT ON INITIAL CONCEPT OF
  OPERATIONS AND MISSION AND FUNCTIONS DOCUMENTS
5. THIS MESSAGE EXECUTIVE SUMMARY DISSEMINATES MCEB MTG RESULTS TO A
WIDE AUDIENCE OF CONCERNED ORGANIZATIONS. CINC REPRESENTATION AT THE
PRINCIPAL LEVEL IS ACHIEVED THROUGH J62, RADM CHARLES R, SAFFELL,
JR., USN, AND AT THE COORDINATOR LEVEL THROUGH J62D, COL A, SCHENCK,
USA. CINC J6 ATTENDANCE AT INDIVIDUAL DISCRETION. NEXT USMCEB
PRINCIPALS MTG WILL BE ON 25 JULY 94 0930-1130. AGENDA WILL BE
ANNOUNCED IN ADVANCE. CINC TOPICS ARE WELCOME AND SHOULD BE
SUBMITTED NLT 1200 ON 5 JUL 94.//
BT
RTTUZYUW RUEKJCS2523 1581659 MTMS-UUUU   NNNN

UNCLASSIFIED

JOINT STAFF
INFO SERVICE CENTER

ZYUW RUEKJCS8552 1461951

ROUTINE
R 251900Z MAY 94
FM JOINT STAFF WASHINGTON DC//J6///
TO   DA WASHINGTON DC//DAMO-FDC/SAIS-SDX//
      ESD WASHINGTON DC///MS/AB3//   HQ USAF WASHINGTON DC//SCM/XO//
      CMC WASHINGTON DC//C4I//   CINCUSACOM NORFOLK VA//J6//
      USCINCCENT MACDILL AFB FL//CC36//
      USCINCEUR VAIHINGEN GE//ECJ6//   USCINCPAC HONOLULU HI//J6//
      USCINCSO QUARRY HEIGHTS PM//SCJ6//
      USCINCSPACE PETERSON AFB CO//J40-J6//
      USCINCSOC MACDILL AFB FL//SOJ6/SCXC//
      USCINCSTRAT OFFUTT AFB NE//J6//
      USCINCTRANS SCOTT AFB IL//TCJ6//
INFO SECSTATE WASHINGTON DC//IM-DLO//
      SECDEF WASHINGTON DC//OASD (C3I)//
      DISA WASHINGTON DC//CFE/UTTM/MSO//
      DIRNSA FT GEORGE G MEADE MD//Q2/G36//
      COMSPAWARSYSCOM WASHINGTON DC//PD50/PD51//
      CDRSIGCEN FT GORDON GA//ATZH-GC/ATZH-IS/ATZH-CDM//
      DIR JIEO FT MONMOUTH NJ//TB9/TBBA//
      COMMARCORSYSCOM QUANTICO VA//C2CMS//
      PM SATCOM FT MONMOUTH NJ//SFAE-CM-SC//
      OL A HQ AFSPACECOM OFFUTT AFB NE//SC2//
      COMARSPACE COLORADO SPRINGS CO//MOSC-IA//
      COMNAVSPACECOM DAHLGREN VA//N3//
      ESC HANSCOM AFB MA//MSP//
      CDR WHCA WASHINGTON DC //IM/SO/DLO//
      CDRJCSE MACDILL AFB FL//JCSE-XP//
      JCG WASHINGTON DC//SMEO//
      COMNAVCOMTELCOM WASHINGTON DC//N3/N5//
      NCCOSC RTDE DIV SAN DIEGO CA//84//

UNCLAS
MSGID/GENADMIN/JOINT STAFF J6I//
SUBJ/5KHZ DAMA VOICE MINIMUM DELAYS//
REF/A/GENADMIN/JOINT STAFF J6I/042E53OZAPR94/-/MOTAL//
POC/CPT KELLEY/CPT/J6S/LOC:PENTAGON/TEL:DSN 227-5986//
RMKS/1. THE UHF SATCOM 5 KHZ DAMA WAVEFORM IN MIL-STD-188-182
WAS PRIMARILY DESIGNED FOR DATA MESSAGES. VOICE SUPPORT IS
INCLUDED BUT HAS INHERENT LINK SETUP DELAYS OF 20-40 SECONDS AND
"PUSH-TO-TALK" DELAYS OF 9-10 SECONDS. RECOGNIZING THE INCREASING
REQUIREMENTS FOR UHF SATCOM VOICE BY OPERATIONAL FORCES, THESE DELAYS
ARE CLEARLY NOT ACCEPTABLE. THE JOINT STAFF HAS THEREFORE TAKEN THE
LEAD IN IMPROVING TIME-SENSITIVE VOICE SUPPORT TO THE OPERATIONAL
FORCES OVER 5 KHZ DAMA.
2. AS A RESULT OF THE MARCH 94 WCEB, DISA JIEO WAS TASKED (REF A) TO
RESOLVE THE 5 KHZ DAMA VOICE DELAY ISSUE. PRELIMINARY LIAISON WITH
DISA JIEO INDICATES THE TECHNICAL FEASIBILITY EXISTS TO REDUCE THE
MAXIMUM INITIAL LINK SETUP DELAY TO LESS THAN EIGHT SECONDS AND
"PUSH-TO-TALK" DELAYS TO LESS THAN TWO SECONDS. THESE TIMES WILL
THEN CONSTITUTE THE MAXIMUM ACCEPTABLE DELAYS. THE NEAR TERM
OPERATIONAL SOLUTION (CITED REF A) TO ASSIGN CRITICAL VOICE USERS TO
NON-5KHZ DAMA CHANNELS (I.E., DEDICATED 5 OR 25 KHZ CHANNELS, OR
25 KHZ DAMA ACCESSES) WILL BE USED UNTIL THE FINAL SOLUTION IS READY
FOR AN INTEGRATED FIELDING.
3. OUR OBJECTIVE IS TO DRIVE THE DELAY TIMES DOWN TO THE LOWEST
LEVEL POSSIBLE; IDEALLY, INCORPORATING A P3I SOFTWARE UPGRADE USING
THE FILL DEVICES FOR OUR NEW DAMA TERMINALS. OUR COLLECTIVE EFFORTS
WILL DECREASE THE DELAYS IN 5 KHZ DAMA, INCREASE THE NUMBER OF USERS
THAT CAN ACCESS LIMITED UHF SATELLITE RESOURCES, AND PROVIDE REAL
TIME REDISTRIBUTION OF COMMUNICATION RESOURCES BASED ON CHANGING
REQUIREMENTS. WE WILL KEEP YOU APPRISED OF OUR PROGRESS.// BT

JOINT STAFF V1   27
ACTION J6(8)   (D,B,7,F)
  VFO   SJS-N(1) CMAS(1) SJS-C(1) MACC:CMO(1) MIDS(1)
        DOCDIV(1) J4(5) QUAL CONTROL(1) J62-J(1) J6M-J(1)
        J6U-J(1) J6R-J(1) J5Z-J(1) J5S-J(1) J6B-J(1)

    : V2   4
                                    (U,7,B,F)
      SECDEF-N(1) SECDEF C(1) OASD:C3I(1)
        SO:C3I-TWU(1)
          C

UNCLASSIFIED

ROUTINE   ZYUW RUEKJCS9406 2040301
R 222300Z JUL 94
FM JOINT STAFF WASHINGTON DC//J61//
TO   DA WASHINGTON DC//DAMO-FOC/SAIS-SDX//
      CNO WASHINGTON DC//N6/N53//   HQ USAF WASHINGTON DC//SCM/XO//
      CMC WASHINGTON DC//C4I//   CINCUSACOM NORFOLK VA//J6//
      USCINCCENT MACDILL AFB FL//CCJ6//
      USCINCEUR VAIHINGEN GE//ECJ6//   USCINCPAC HONOLULU HI//J6//
      USCINCSO QUARRY HEIGHTS PM//SCJ6//
      USCINCSPACE PETERSON AFB CO//J40-J6//
      USCINCSOC MACDILL AFB FL//SOJ6/SODC//
      USCINCSTRAT OFFUTT AFB NE//J6//
      USCINCTRANS SCOTT AFB IL//TCJ6//
INFO SECSTATE WASHINGTON DC//IM-DLO//
      SECDEF WASHINGTON DC//OASD (C3I)//
      DISA WASHINGTON DC//CFE/UTTM/MSO//
      DIRNSA FT GEORGE G MEADE MD//Q2/GS6//
      COMSPAWARSYSCOM WASHINGTON DC//PD50/PD51//
      CDRSIGCEN FT GORDON GA//ATZH-DC/ATZH-TS/ATZH-CDM//
      DIR JIEO FT MONMOUTH NJ//TBB/TBBA//
      COMJSOC FT BRAGG NC//J6//
      COMMARCORSYSCOM QUANTICO VA//C2CMS//
      PM SATCOM FT MONMOUTH NJ//SFAE-CM-SC//
      OL A HQ AFSPACECOM OFFUTT AFB NE//SCZ//
      COMARSPACE COLORADO SPRINGS CO//MOSC-ZA//
      COMNAVSPACECOM DAHLGREN VA//N3/N5//
      ESC HANSCOM AFB MA//MSP//
      CDR WHCA WASHINGTON DC//IM/SO/DLD//
      CDRJCSE MACDILL AFB FL//JCSE-XR//
      7CG WASHINGTON DC//SMCO//
      COMNAVCOMTELCOM WASHINGTON DC//N3/N5//
      NCCOSC RTDE DIV SAN DIEGO CA//84//

UNCLAS
MSGID/GENADMIN/JOINT STAFF J61//
SUBJ/5KHZ DAMA VOICE FIX//
REF/A/GENADMIN/JOINT STAFF J61/251900ZMAY94/-/NOTAL//
POC/CPT KELLEY/CPT/J6S/LOC:PENTAGON/TEL:DSN 227-5965//
RMKS/1. THIS MESSAGE UPDATES REF A ON OUR EFFORTS TO MINIMIZE
THE 5 KHZ DAMA VOICE DELAYS. DISA JIEO, WITH JSOC ASSISTANCE, HAS
EMBARKED ON A DEVELOPMENT AND ACQUISITION STRATEGY TO SHORTEN THE
TIME DELAYS TO ACCEPTABLE LEVELS BY REDUCING THE 5 KHZ DAMA BURST
FRAME DURATION USING A MORE BANDWIDTH EFFICIENT MODULATION TECHNIQUE.
DISA JIEO HAS ALREADY SURVEYED INDUSTRY AND DETERMINED THAT
COMMERCIAL, STATE-OF-THE-ART MODULATION TECHNIQUES EXIST WHICH CAN BE
USED TO MINIMIZE THE 5 KHZ DAMA VOICE TIME DELAYS WITH A MINIMUM
IMPACT ON USER TERMINALS.
2. THE DISA JIEO STRATEGY WILL BE TO:
A. RELEASE A REQUEST FOR PROPOSAL (RFP) TO INDUSTRY FOR ADVANCED
MODULATION TECHNOLOGY MODEMS BY OCTOBER 1994. THE RFP WILL REQUIRE A
DEMONSTRATION MODEL AND PURCHASING RIGHTS TO THE ADVANCED MODULATION
TECHNOLOGY.
B. EVALUATE CONTRACTOR PROPOSALS, SELECT THE BEST ADVANCED
MODULATION TECHNIQUE, AND AWARD A CONTRACT FOR PROTOTYPE MODEMS FOR
TESTING AND MIL-STD-188-182 (5 KHZ DAMA WAVEFORM) VALIDATION IN
MARCH 1995.
C. FIELD TEST THE PROTOTYPE MODEMS AND INCORPORATE THE ADVANCED
MODULATION TECHNIQUE INTO MIL-STD-188-182 BY 31 MARCH 1996.
D. PROVIDE THE 5 KHZ DAMA FIX TO THE SERVICES TO UPGRADE DAMA
TERMINALS BY SEPTEMBER 1996.
3. THE UPGRADED 5 KHZ DAMA WAVEFORM WILL PROVIDE AT LEAST A THREE
HUNDRED PERCENT REDUCTION IN DAMA FRAME DURATION AND DELAY TIMES.
OUR OBJECTIVES FOR THE UPGRADED WAVEFORM DESIGN ARE TO REDUCE:

JOINT STAFF V1   29
ACTION J6(8)   (D,6,7,F)
INFO   SJS-W(1) CMAS(1) SJS-C(1) NMCC:CNO(1) J3(3) NIDS(1)
       J4(5) QUAL CONTROL(1) J62-J(1) J6N-J(1) J6U-J(1)
       J6R-J(1) J6Z-J(1) J6S-J(1) IMD-J(1)

SECDEF V2   14
ACTION   (U,7,8,F)
INFO   SECDEF-N(1) BMDO(3) SECDEF-C(1)
       USDAT:PL(1) USDAT:ADMIN(1) OASD:C3I(1) USDAT:IP(2)
       ATSD:PA(1) USDP:CT(1) USDP:PP(1) USDP:SS(1)
       +SAFE

FRAME DURATION TO 2.25 SECS OR LESS, CALL SET-UP T
LESS, AND PUSH-TO-TALK TIME TO 2 SECS OR LESS. EV
MADE TO IMPROVE THESE MAXIMUM ACCEPTED DELAY TIMES
4. THE NEAR TERM OPERATIONAL SOLUTION (CITED REF
CRITICAL VOICE USERS TO NON-5KHZ DAMA CHANNELS (1
5 OR 25 KHZ CHANNELS, OR 25 KHZ DAMA ACCESSES) WI
THE FINAL FIX IS READY FOR AN INTEGRATED FIELDING
WILL DECREASE THE DELAYS IN 5 KHZ DAMA' INCREASE
THAT CAN ACCESS LIMITED UHF SATELLITE RESOURCES.
TIME REDISTRIBUTION OF COMMUNICATION RESOURCES BA
REQUIREMENTS' WE WILL KEEP YOU APPRISED OF OUR P

Post-It™ brand fax transmittal memo 7671 | # of pages ►

To Mr Andy Rhoxx	From
Co. LTC Barksdale	Co.
Dept.	Phone #
Fax # 8-492-7883	Fax #

type 11
oad number (type ? for help)
:- type 1
Message # 1: 6833 bytes)
MS-MSG-NBR: A942850212
late: WED, 12 OCT 1994, 18:06:00 LOCAL
rom: "JOINT STAFF WASHINGTON DC//J61//"@ams.com   -
:c: amsel-gs-a@CECOM3.MONMOUTH.ARMY.MIL,
            sfae-cm-sc@monmouth-emh3.army.mil,
            sfae-cm-xo@monmouth-emh3.army.mil, tbb@CECOM2.MONMOUTH.ARMY.MIL,
            tbba@monmouth-emh2.army.mil, tcc@ams.com
subject: [R] UHF DAMA ISSUES//

TAUZYUW RUEKJCS3709 2852210-UUUU--RUERMOO.
NR UUUUU
2 122200Z OCT 94
M JOINT STAFF WASHINGTON DC//J61//
O RUCJAAA/USCINCSOC MACDILL AFB FL//SOJ6//
UCJACC/USCINCCENT MACDILL AFB FL//CCJ6//
UHQHQB/USCINCPAC HONOLULU HI//J6//
NFO RUEADWD/DA WASHINGTON DC//DAMO-FDC/SAIS-SDX//
UENAAA/CNO WASHINGTON DC//N6/N63//
UEAHQA/HQ USAF WASHINGTON DC//SCM/XO//
UEACMC/CMC WASHINGTON DC//C4I//
UCBSAA/CINCUSACOM NORFOLK VA//J6//
USNNOA/USCINCEUR VAIHINGEN GE//ECJ6//
HLBAAU/USSOUTHCOM SCJ6 QUARRY HEIGHTS PM//
UWTNOK/USCINCSPACE PETERSON AFB CO//J40-J6//
UCUSTR/USCINCSTRAT OFFUTT AFB NE//J6//
HCUAAA/USCINCTRANS SCOTT AFB IL//TCJ6//
UEHC/SECSTATE WASHINGTON DC//IM-DLO//
UEKJCS/SECDEF WASHINGTON DC//OASD (C3I)//
UEJDCA/DISA WASHINGTON DC//D6/D8//
UETIAA/DIRNSA FT GEORGE G MEADE MD//Q2/G56//
ULSSPA/COMSPAWARSYSCOM WASHINGTON DC//PD50/PD51/PMW176//

AGE 02 RUEKJCS3709 UNCLAS
UERGAA/CDRSIGCEN FT GORDON GA//ATZH-DC/ATZH-TS/ATZH-CDM//
UERMOO/DIR JIEO FT MONMOUTH NJ//TBB/TBBA//
UEOFAA/COMJSOC FT BRAGG NC//J6//
ULSMCA/COMMARCORSYSCOM QUANTICO VA//C2CMS//
UERMOO/PM SATCOM FT MONMOUTH NJ//SFAE-CM-SC//
UWTNOK/HQ AFSPC PETERSON AFB CO//SCZ//
UEASPC/COMARSPACE COLORADO SPRINGS CO//MOSC-ZA//
ULSLAC/COMNAVSPACECOM DAHLGREN VA//N3/N5//
UEOFFA/ESC HANSCOM AFB MA//MSP//
HEHAAA/CDRWHCA WASHINGTON DC //IM/SO/DLD//
UCJJCS/CDRJCSE MACDILL AFB FL//JCSE-XR//
UEAHQA/7CG WASHINGTON DC//SMCO//
ULSWCB/COMNAVCOMTELCOM WASHINGTON DC//N3/N5//
UWFOAA/NCCOSC RTDE DIV SAN DIEGO CA//84//
T
NCLAS
SGID/GENADMIN/JOINT STAFF J61//
UBJ/WARFIGHTER UHF DAMA ISSUES//
EF/A/GENADMIN/USCINCSOC SOJ6/231300ZSEP94/-/NOTAL//
EF/B/GENADMIN/USCINCPAC J6/082000ZSEP94/-/NOTAL//

PAGE 03 RUEKJCS3709 UNCLAS
NARR/REF A IS COORDINATED USCINCSOC AND USCENTCOM MESSAGE ON THEIR
CONCERNS WITH DEMAND ASSIGNED MULTIPLE ACCESS (DAMA) IMPLEMENTATION.
REF B IS A USCINCPAC MESSAGE EXPRESSING CONCERNS ON DAMA ISSUES.//
POC/SLATON/CDR/J6S/LOC:PENTAGON/TEL:DSN 227-8076//
RMKS/1. THIS MESSAGE IS AN INITIAL RESPONSE TO WARFIGHTER UHF
DAMA CONCERNS IN REFS A AND B. THE JOINT STAFF AND DISA JIEO ARE
SEEKING SOLUTIONS TO THESE AND OTHER DAMA ISSUES. TO ACCOMPLISH
THIS' THE JOINT STAFF AND DISA JIEO WILL CO-CHAIR A DAMA MEETING WITH
CINC' SERVICE AND AGENCY REPRESENTATIVES DURING MILSATCOM USERS
CONFERENCE 2-94 (15-16 NOV). SPECIFIC TIME AND LOCATION WILL BE
PROVIDED BY SEPCOR:
A' ENSURE ALL DAMA ISSUES HAVE BEEN IDENTIFIED;
8. REVIEW RECOMMENDED ISSUE RESOLUTION OPTIONS THAT WILL RECOGNIZE
    AND ADDRESS TECHNICAL, OPERATIONAL, AND PROGRAMMATIC
    CONSIDERATIONS;
C' DEVELOP A PLAN OF ACTION THAT RESOLVES THE ISSUES;
D. ESTABLISH A PROCESS THAT ENSURES USER COMMUNITY INVOLVEMENT IN
    ONGOING AND FUTURE DAMA STANDARDS AND IMPLEMENTATION ISSUES.
2. THIS PLAN OF ACTION WILL FORM THE BASIS TO PROVIDE GUIDANCE TO
THE UHF JOINT MILSATCOM TECHNICAL WORKING GROUP (WG), THAT IS

PAGE 04 RUEKJCS3709 UNCLAS
CURRENTLY DEVELOPING MIL-STD-188-185 FOR THE JOINT INTEGRATED DAMA
CDNTROLLER, AND TO SERVICE DEVELOPERS THAT ARE IMPLEMENTING THE
STANDARD.
3. THE FOLLOWING INITIAL COMMENTS ARE PROVIDED TO MAJOR ISSUES OF
CONCERN FROM REFS A AND B:
A. USER EDUCATION ON DAMA CAPABILITIES AND SERVICES: DISA JIEO IS
INITIATING A SECOND DISTRIBUTION OF THE DAMA TUTORIAL PAMPHLETS FOR
UHF SATCOM DAMA MODES OF OPERATION. WIDEST DISSEMINATION AMONG THE
USER COMMUNITY' CINC AND SERVICE STAFFS IS RECOMMENDED.
B' 5 KHZ DAMA DELAYS: THE 5 KHZ DAMA DELAY FIX, APPROVED BY THE
MCEB' IS ENVISIONED TO BE A P3I UPGRADE USING THE DISA JIEO ADVANCED
UHF SATCOM MODEM (AUSM) INITIATIVE TO MINIMIZE DAMA DELAYS. AUSM
WILL USE AN ADVANCED MODULATION TECHNIQUE TO REDUCE FRAME SIZE WHILE
INCREASING DATA RATE THROUGHPUT.
C. DIFFERENT FRAME SIZE/FORMATS: ALTHOUGH NO DOCUMENTED CINC
OR SERVICE REQUIREMENT EXISTS FOR SEAMLESS TRANSITION BETWEEN 5 KHZ
AND 25 KHZ UHF SATCOM CHANNELS' DISA JIEO WILL INVESTIGATE THE
FEASIBILITY OF MODIFYING THE AUSM INITIATIVE TO ACCOMODATE THIS
CAPABILITY, AND DISCUSS TRADEOFFS THAT MAY HAVE OPERATIONAL AND
PROGRAMMATIC IMPACTS AT THE UHF DAMA MEETING.

PAGE 05 RUEKJCS3709 UNCLAS
D. DIFFERENT CRYPTO PERIODS: THERE IS NO TECHNICAL REASON WHY THE
CRYPTO PERIODS CANNOT BE THE SAME. THE CURRENT DRAFT JOINT KEY
MANAGEMENT PLAN PROPOSAL FOR A SINGLE CRYPTO PERIOD WILL BE DISCUSSED
AT THE UHF DAMA MEETING.
E. SYSTEM MANAGEMENT AND CONTROL:
(1). MIL-STD-188-185: THE UHF JOINT MILSATCOM TECHNICAL WG WILL
ENSURE FUTURE CINC AND SERVICE INVOLVEMENT IN COMPLETING THE
DEVELOPMENT OF MIL-STD-188-185 FOR THE JOINT INTEGRATED DAMA
CONTROLLER (JIDC).

E-12

2). CONTROLLER DEVELOPMENT: THE 31 MAY MCEB DIRECTED THAT THE NAVY
E THE LEAD DEVELOPER FOR THE JIDC WITH ASSISTANCE FROM THE AIR
ORCE. NAVY WILL ASSUME FUNDING REPSPONSIBILITY FOR JIDC
EVELOPMENT, AND BOTH SERVICES WILL PROCURE JOINT INTEGRATED DAMA
ONTROLLERS FOR THE FUTURE JIDC SITES (CURRENTLY UNDER JOINT
TUDY BY AIR FORCE AND NAVY)' NAVY (N63) WILL BRIEF THE OCTOBER MCEB
N PLANS TO DEVELOP THE JIDC' THE INITIAL AIR FORCE AND NAVY 5 AND
5 KHZ CONTROLLERS, RESPECTIVELY, WERE PROCURED PRIOR TO THE JIDC
NITIATIVE AND WILL BE USED UNTIL THE JIDC SYSTEM IS FIELDED.
3). CENTRAL CONTROL AND MANAGEMENT: PREVIOUS STAFFING WITH THE
INCS AND SERVICES FOR THE DAMA CONOPS ESTABLISHED A SCHEME FOR

AGE 06 RUEKJCS3709 UNCLAS
ENTRALIZED CONTROL AND DE-CENTRALIZED MANAGEMENT OF UHF SATCOM
SSETS TO SATISFY WARFIGHTER REQUIREMENTS. THERE HAVE BEEN NO
HANGES TO THIS SCHEME.
4). SILENT MODE HANDOFF: UHF SATCOM USERS IN SILENT TERMINAL MODE
O NOT HAVE TO IDENTIFY THEMSELVES TO A NEW CONTROLLER WHEN MOVING
ROM ONE SATELLITE AREA OF COVERAGE TO AN ADJACENT AREA OF COVERAGE.
ONTROLLERS WILL BE LOCATED AT AREAS OF OVERLAPPING COVERAGE AND WILL
E ELECTRONICALLY LINKED' THEREFORE, NO CONTROLLER HANDOFF IS
EQUIRED. A TRULY SILENT TERMINAL DOES NOT HAVE TO LOGIN OR RANGE,
ND THUS CAN MOVE TO ANY CHANNEL ON ANY SATELLITE. IF THE TERMINAL
UST BECOME ACTIVE AND TRANSMIT, IT MUST FIRST RANGE TO THE SATELLITE
EFORE BEGINNING A TRANSMISSION.
' YOUR COMMENTS AND RECOMMENDATIONS TO SUPPORT IMPROVED UHF SATCOM
SE TO THE WARFIGHTER ARE APFRECIATED. A SPECIFIC DATE AND LOCATION
OR THE DAMA MEETING REFERENCED ABOVE WILL BE COORDINATED WITH YOU
ND ANNOUNCED BY SEPARATE ACTION. THIS MESSAGE HAS BEEN COORDINATED
ITH DISA JIEO.//
T

------------------------------- Message Contents -------------------------------

fyi

_____ Forward Header _____

RTAUZYUW RUEKJCS9962 0932134-UUUU--RUERMOO.
ZNR UUUUU
R 032108Z APR 95
FM JOINT STAFF WASHINGTON DC//J6S//
TO RUERMOO/PM SATCOM FT MONMOUTH NJ//SFAE-CM-SC//
RUEOFAA/COMJSOC FT BRAGG NC//J6//
RUENAAA/CNO WASHINGTON DC//N63//
RUEAHQA/HQ USAF WASHINGTON DC//SCM//
RUEACMC/CMC WASHINGTON DC//C4I/CSBI//
INFO RUERMOO/DIR JIEO FT MONMOUTH NJ//TBB/TBBA//
BT
UNCLAS
MSGID/GENADMIN/JOINT STAFF J6S//
SUBJ/ADVANCED UHF SATCOM MODULATION (AUSM)//
1. DISA-JIEO IS LEADING AN EFFORT TO DEVELOP AND ACQUIRE AN ADVANCED
UHF SATCOM MODULATION APPLICATION TO SATISFY A JSOC REQUIREMENT FOR
INCREASED DATA RATE THROUGHPUT AT 5 AND 25 KHZ (OBJECTIVE DATA RATES
ARE 9.6 KBPS AND 48 KBPS, RESPECTIVELY).
2. JIEO WILL ENCOURAGE SYSTEM IMPLEMENTOR PARTICIPATION EARLY IN THE
SELECTION AND ACQUISITION PROCESS, TO ENSURE PM-SATCOM, JSOC, AND
SERVICES ARE PARTY TO ISSUES IMPACTING/ENHANCING ONGOING UHF SATCOM
PROGRAMS (I.E. TERMINALS, AND 5/25 KHZ CONTROLLERS).

PAGE 02 RUEKJCS9962 UNCLAS
3. AS A SEPARATE BUT RELATED ISSUE, THE MODULATION TECHNIQUE
SELECTED FOR THE AUSM EFFORT, PLUS OTHER EMERGING TECHNOLOGIES WILL
PROVIDE JIEO WITH OPTIONS FOR DEVELOPMENT OF NEXT-GENERATION 5/25 KHZ
DAMA WAVEFORMS THAT ARE INTEROPERABLE AND MINIMIZE 5 KHZ VOICE DAMA
SETUP AND PUSH-TO-TALK DELAYS. JIEO WILL DETERMINE TERMINAL PROGRAM
MODIFICATION COSTS, AND JOINT STAFF WILL USE RESULTS TO PERFORM
COST/BENEFIT ANALYSIS. JOINT STAFF WILL FORWARD A SERVICE-
COORDINATED RECOMMENDATION TO THE MCEB FOR DECISION.//
BT